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REPORT

OF THE

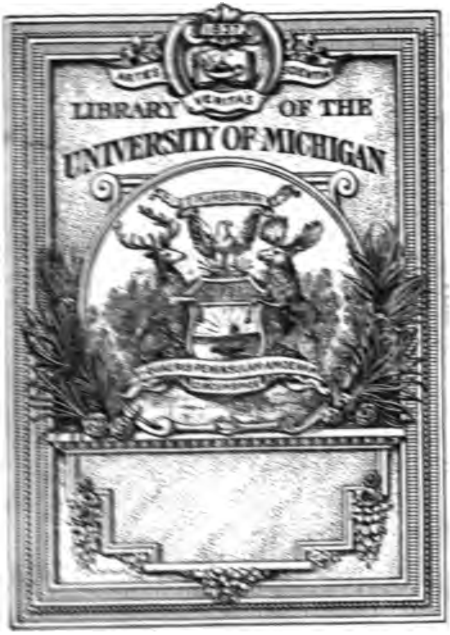
Forestry Commission

— OF —

New Hampshire.

JUNE SESSION, 1885.

Concord, N. H.
Parsons B. Cogswell, Public Printer.
1885.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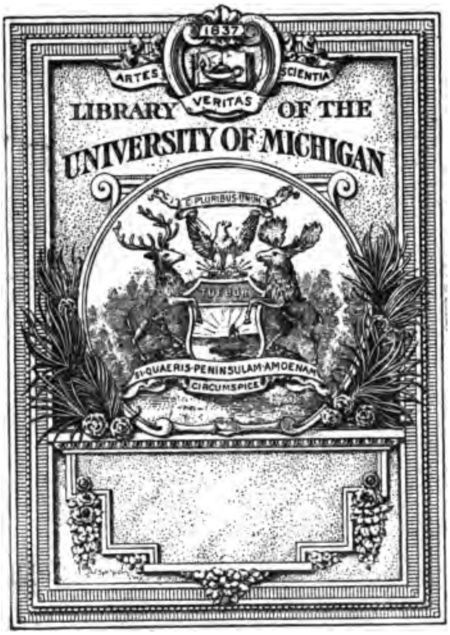
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REPORT

OF THE

FORESTRY COMMISSION

OF

NEW HAMPSHIRE.

JUNE SESSION, 1885.

CONCORD:
PARSONS B. COGSWELL, PUBLIC PRINTER.
1885.

REPORT.

To the Senate and House of Representatives of the State of New Hampshire:

The Forestry Commission have the honor to submit their report, agreeably to the provisions of the following legislative acts:

I. Act approved July 29, 1881.

Resolved by the Senate and House of Representatives in General Court convened:

That the governor, and such associates as he may appoint to act with him, are hereby constituted a commission to institute an inquiry into the extent to which the forests of New Hampshire are being destroyed by the indiscriminate cutting of wood and timber for transportation to other states; also, the effect, if any, produced by the destruction of our forests upon our rain-fall, and consequently upon our ponds and streams, and into the wisdom or necessity for the adoption of forest laws. Said commission shall serve without compensation or expense to the state, and shall make a report to the legislature, which shall be prepared at least sixty days before the session of June, 1883; and the state printer shall print for public distribution, under the direction of said commission, as many copies of such report as the commission may direct.

II. *Resolved by the Senate and House of Representatives in General Court convened:*

The commission appointed under the joint resolution of July 29, 1881, to institute an inquiry concerning the wisdom and necessity of forest laws, etc., is hereby extended two years.

189029

Said commission shall make a report to the legislature, which shall be prepared at least sixty days before the session of June, 1885, to be printed for distribution as provided by said resolution.

Said commission shall serve without compensation; but a sum not exceeding three hundred dollars is hereby appropriated to pay the necessary expenses incurred in collecting the facts required by said resolution to be ascertained and reported, to be audited and paid on the warrant of the governor.

Act approved September 15, 1883.

FOREST AREAS.

It is impossible, with the means at our disposal, to ascertain with absolute accuracy the forest areas of the state. We may, however, quite closely approximate them.

New Hampshire has a length of about one hundred and eighty miles, a breadth in the widest place of about one hundred, and a total area of about five and three quarters millions (5,763,200) of acres.

SIZES OF FOREST AREAS.

It has five important river basins, which contribute very largely to sustain five important rivers, viz., the Connecticut, the Merrimack, the Piscataqua, the Saco, and the Androscoggin. These and their tributaries, as will appear upon a minute's reflection, afford a very large part of the water-power of New England. Upon their banks have been built Holyoke, Auburn, Lewiston, Bellows Falls, Lawrence, Lowell, Nashua, Manchester, Concord, Franklin, Great Falls, Dover, Saco, Biddeford, Brunswick, and many other manufacturing towns within and without this state. The fifteen particularly named had, in 1880, an aggregate population of two hundred and forty thousand five hundred and thirty-five persons.

Upon the bottoms and the smoother sides of these basins are considerable tracts of land, some of which are of excellent quality, but a very large proportion of their rougher slopes are insusceptible of arable culture.

If we look more particularly at the character of these surfaces, it will be found that we have of

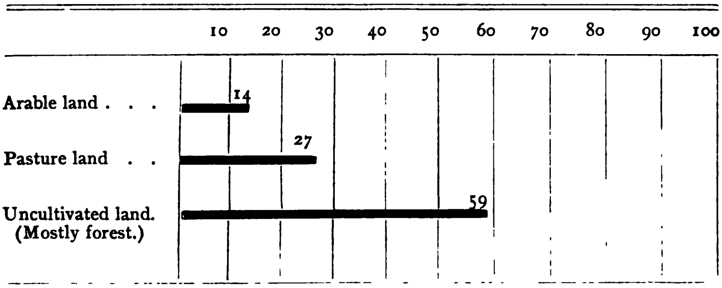
1st. Tillage land, about . . .	800,000 acres
2d. Pasture land, about . . .	1,508,112 "
3d. Unimproved land, mostly forest, .	3,455,088 "

The proportion of arable land is very small, being but about one seventh of the whole area. As this cannot be much increased, agricultural improvement in New Hampshire must advance along the lines of a higher culture of the areas now worked.

The pasture area may be somewhat enlarged, if its extension be deemed desirable. This, however, is problematical, as much land already in pasture would yield better returns if kept in wood and timber.

The unimproved land, including water surfaces, town sites, and highways, is mostly in forest, and amounts to about fifty-eight per cent. of all the land of the state, and is for the most part incapable of successful tillage, being better adapted to the production of wood and timber than to any other purpose. There is some land yet in forest which might be profitably cleared, but there is also as much now devoted to the plow and pasturage, which must soon revert to forest. Such changes, however, will not materially affect the sizes of the areas just mentioned.

The horizontal lines of the following table show at a glance these several proportions of arable, pasture, and forest land in the state.

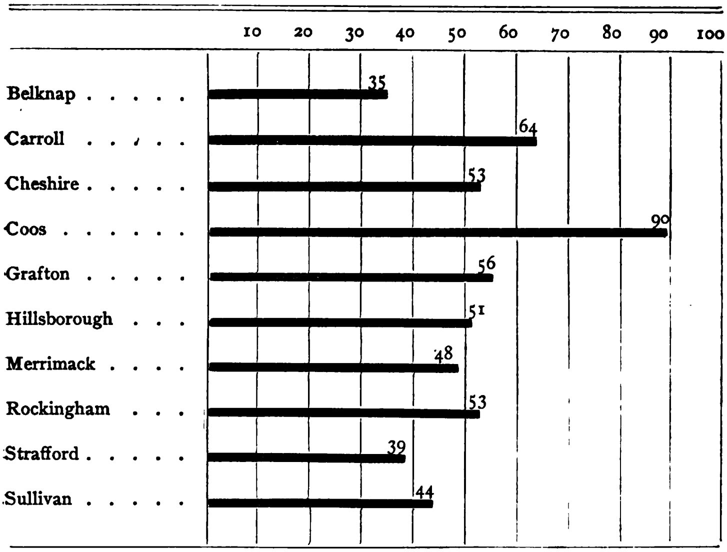


To exhibit these proportions more in detail, we present the following table of the whole number of acres of land in each county, the amounts of improved and of unimproved land in each, together with the several percentages of the latter.

Counties.	Areas of Each.	Improved Land.	Unimproved Land.	Per cent. of Unimproved Land.
Belknap........	256,000 acres	167,167 acres	88,883 acres	35 per cent.
Carroll.........	499,200 "	180,575 "	318,626 "	64 "
Cheshire.......	499,200 "	233,845 "	265,355 "	53 "
Coös...........	1,267,200 "	139,089 "	1,128,171 "	90 "
Grafton.......	976,000 "	425,783 "	550,217 "	56 "
Hillsborough..	627,200 "	301,752 "	325,448 "	51 "
Merrimack.....	588,800 "	305,282 "	283,518 "	48 "
Rockingham..	473,600 "	223,544 "	250,056 "	58 "
Strafford......	204,800 "	125,087 "	79,713 "	39 "
Sullivan.......	371,200 "	205,988 "	165,212 "	44 "
	5,763,200 acres	2,308,112 acres	3,455,149 acres	

The above table shows that the amount of unimproved area, mostly in forest, varies from 35 per cent. in Belknap to 90 per cent. in Coös, and that the cleared and wooded surfaces in Hillsborough, Rockingham, Cheshire, and Merrimack are very nearly equal, being in each about 50 per cent. of their total area. It should be borne in mind that considerable portions of Belknap and Carroll counties are covered with water, a fact which must not be forgotten when considering the unimproved areas of those counties.

The following table of lines drawn against the names of the several counties shows at a glance the several proportions of unimproved, and for the most part forest, area of each:



It is a notable fact, that during the last thirty years the percentage of unimproved land in farms has been increasing. It was

$33\frac{3}{10}$	per cent. in	1850
$36\frac{8}{10}$	"	1860
$35\frac{3}{10}$	"	1870
38	"	1880

an increase of $4\frac{7}{10}$ per cent. in thirty years, or about 54,090 acres, equal to two good-sized townships, showing that considerable areas once under cultivation have already relapsed to forest.

The foregoing statements lead to these conclusions, viz.,—

1. That a little more than one half of the state is now in forest of some kind, varying in density all the way from the sprout growths following recent cuttings, to the dense primeval woods to which the axe is still a stranger.

2. That the geological character of New Hampshire is such that this proportion of wooded and cleared surface can never profitably be very much reduced, and that in the future, as in the past, New Hampshire must continue largely a wood- and

timber-bearing state. The great water-powers within and with out our limits, which our rivers supply, demand this. The close proximity of the raw material afforded by the forests to the innumerable water-powers of easy application to their manufacture suggests this. Nature herself, in the very configuration of the state's surface, and in the character of its soil, absolutely commands that whatever may be the preference of its inhabitants, at least one half of it shall remain perpetually devoted to the production of wood and timber, and that what nature has unalterably ordained, it becomes them to accept.

FOREST PRODUCTS.

It would be difficult to obtain a perfect list of all the forest products of New Hampshire for any given year. That presented below, derived partly from the census returns and partly from careful estimates made by persons engaged in and familiar with different branches of this industry, is at least approximately accurate, but below rather than above the exact truth. It is as follows, viz.,—

1. The number of lumbering establishments in this state in 1880 was six hundred and eighty. They possessed a cash capital of three million seven hundred and forty-five thousand seven hundred and ninety dollars ($3,745,790), and afforded employment to thirty-one hundred and four men and boys. All of these, with the exception of forty-eight, were over fifteen years of age. The wages paid them amounted to five hundred and forty-eight thousand five hundred and fifty-six dollars ($548,556), and the value of the logs used previous to their manufacture was $2,151,461

The products of these mills were,—

Lumber, . . .	292,267,000	feet, board measure.
Spool and bobbin stock,	3,072,000	" "
Laths, . . .	49,454,000	
Shingles, . . .	67,086,000	
Staves, . . .	31,354,000	
Sets of headings, .	3,491,000	

These, together with a few other articles not particularly designated, had a total value of three million eight hundred and forty-two thousand and twelve dollars ($3,842,012).

2. The value of the wood and timber sold or consumed upon farms the same year was . . $2,046,888

3. Experts have estimated the amount of logs cut in New Hampshire, and annually floated down our four principal rivers, as follows, viz.,—

Down the Androscoggin, from twelve to fifteen millions of feet, say .	13,500,000 feet.
the Connecticut, from twenty to thirty-five millions, say	27,500,000 "
the Saco, ...	7,900,000 "
the Merrimack, . . .	6,000,000 "
a total of . . .	54,900,000 "

and worth at the river landings whence they are started outside the state, not far from an average price of eight dollars per thousand, or $439,200

It appears from the foregoing that these three items, of logs used at mills within the state, of wood and timber consumed or sold upon farms, and of lumber leaving the state in the log, all unmanufactured products, amount annually to $4,637,549

To these should be added the large quantities of wood, fence-posts, and sleepers sold to railroads, telegraph-poles, pulp-wood, bark, etc., the value of which must increase this amount to five millions of dollars, and probably more.

The relative annual value of these crude products of our forests to that of our principal primitive agricultural crops is apparent upon a comparison of the two. The latter, as given in the United States census of 1880, was about ten millions of dollars, viz.,—

Barley,	77,877 bushels,	at 90 cts.,	$70,089.00
Buckwheat,	94,090 "	75 "	70,573.25
Corn,	1,350,248 "	80 "	1,080,198.00

Oats,	1,017,620	bushels,	at 40 cts.,	$407,048.00
Rye,	34,638	"	80 "	27,710.00
Potatoes,	3,358,828	"	40 "	1,343,543.00
Wheat,	169,316	"	$1	169,316.00
Orchard products,				972,291.00
Hay,	583,069	tons	at $10 per ton,	5,830,690.00
Hops,	23,955	pounds,		4,053.00
Total value,				$9,975,511.25

while those of the forest above mentioned amount to about one half of that sum. Were all these latter given their ultimate value by manufacture within our own state, our receipts therefrom would be doubled, our population would be increased, and local markets created for all, and far more than all, of the present productions of our farms.

It should also be remembered that our forests require no manipulation or fertilization of the soil upon which they stand. They are self-supporting, and by their presence improve constantly rather than deteriorate the condition of the ground which they occupy.

SUMMER VISITORS.

Within the last thirty or forty years a new industry has made its appearance in New Hampshire. Reference is here made to the entertainment of summer visitors who come among us every year. Indeed, this state has already become an important sanitarium, not to thousands, but to millions rather, residing in almost all sections of the United States. Our mountains and hills, our lakes and streams, our pure air and clear waters, our green hills and waving forests, are a constant attraction which grows stronger and extends farther year after year. The proprietor of one of our northern hotels remarked some seven or eight years ago that he well remembered the year when the combined receipts of all the mountain hotels was but twelve thousand dollars, but that during the one previous, those hotels, increased in size and in numbers, had taken twelve hundred thousand dollars.

A minute's glance at our location, with reference to neighboring states, demonstrates the important fact that some six mill-

THE FORESTS OF NEW HAMPSHIRE,

IN THEIR RELATION TO THE AMOUNT OF RAIN-FALL, THE WATER-SUPPLY, AND THE CLIMATE OF THE STATE.

That there is a close connection between the extent and distribution of the forests in any region, and the amount and character of the water-supply, the climate, and perhaps the amount of rain-fall in the same region, is doubtless true, and, taking the country at large, is supported by well known facts and records. The general principles that underlie the whole subject are, that the atmosphere within and around a forest-clad area is cooler than that of the open country, and, during the growing season at least, uniformly contains more moisture,—conditions favorable to an increased amount of precipitation. And what is equally important, this well-shaded and absorbent forest soil is Nature's treasure-house for the storage and distribution of this vast supply of fertility and mechanical power, in a way that secures the greatest benefit and the least injury.

As to the general relations between forests and climate throughout New England, perhaps Prof. C. S. Sargent, who has studied the subject as much as any one, expresses the commonly received opinion, when he says that "as moderators of the extremes of heat and cold, the benefits from extensive forests are undoubted; and that our climate is gradually changing through their destruction, is apparent to the most casual observer. Our springs are later, our summers are drier, and every year becoming more so; our autumns are carried forward into winter, while our winter climate is subject to far greater changes of temperature than formerly. The total average of snow-fall is perhaps as large as ever, but it is certainly less regular, and covers the ground for a shorter period than formerly. Twenty years ago peaches were a profitable crop in Massachusetts; now we must depend on New Jersey and Delaware,—and our apples now come from beyond the limits of New England. The failure of these and other crops in the older states is generally ascribed to the exhaustion of the soil, but with greater reason it can be referred to the destruction of the forests which sheltered us from the cold winds of the North and West, and which, keeping the soil under their shade cool in summer and warm in winter, acted at once as material barriers and reservoirs of moisture."

For the purpose of ascertaining the condition of things in New Hampshire in reference to the subject, circulars were addressed to town authorities and many of the older inhabitants, requesting information as to the following points:

1. Has the amount of water in the streams, ponds, and springs in your region diminished within your remembrance?

2. If so, is it your opinion that the removal of the woods and forests has had anything to do with this change? Please state any *facts* within your knowledge bearing upon this point.

3. Is it the opinion of your older inhabitants that the removal of the forests has in any way affected the climate or the amount of rain-fall?

About fifty replies were received, including every section of the state. Many of these replies were a simple "Yes" or "No," while considerable and important districts failed to respond in any way. Not a few, however, have responded so fully and intelligently, that the summary of these replies, given below, gives in the main a correct view of the opinions prevalent in the state on the questions proposed, and some of the facts on which they are based.

Beginning with the southern portion of the state, and with the town of Richmond, attention is called to a small stream there, which in 1865 furnished sufficient power for four saw-mills nearly all the year, but which began to dry up with the more rapid removal of the timber, occasioned by the introduction of steam as an auxiliary power. The water and the woods have disappeared together, and the same is the case in other portions of the town.

In Fitzwilliam and Rindge the same results have been reached all the more rapidly because of the nearer proximity of these towns to a market. Well known trout-streams, once abundantly stocked with fish, are now dry one half of the year, and the treeless ground and naked rocks along their banks and about their sources is considered a sufficient explanation.

In Chesterfield it has been noticed that even if the amount of water be the same as formerly, the soil does not retain the moisture as it once did, and the flow of the springs and streams is irregular, as was not the case when the country was first settled. The same is true of the streams about Nashua, as reported by an old and intelligent resident.

The waters of the Merrimack are retained by dams at the great lakes and ponds which feed the river, and water is supplied as needed. This secures a comparatively regular flow, and protects against freshets. It is not surprising, therefore, if no great variation has been observed in the city of Manchester. Carefully prepared tables, furnished by the agent of the Amoskeag Manufacturing Company, covering the years 1859–'64, and 1875–'83, show that it has been possible to keep the dam very nearly full at all times. The years 1882–'83 were the only ones in which there appears to have been a marked deficiency, and these were years of general drouth.

One of the oldest residents of Franklin, who has noted the condition of the Merrimack at that point for the past sixty years, is of opinion that the amount of water has decreased one fourth in that period. Here again it is only the storage of water along the affluents of this stream (the Pemigewasset and Winnipiseogee rivers) that gives protection against those irregularities which already have crippled most of the smaller streams in the same region.

The chairman of the board of selectmen in Henniker, who has given much attention to the subject, is confident that the water in the Contoocook river has decreased fully one third within even twenty years, and that the tributaries have fallen off still more, many being nearly dry in the summer. During this period $75,000 worth of timber has been cut within this one town. In the surrounding towns, also, the timber has disappeared with equal rapidity, and the water-supply has seriously decreased.

The report from Bow, which covers a period of fifty years, within which most of the timber has been cut off, and that from Hopkinton, which covers a period of sixty years, both tell the same story of naked hillsides and diminished streams.

Dunbarton, on the other hand, has not suffered so much from the lack of water (which has been about the same in amount for the past sixty years) as from the irregularity of its supply; but this irregularity is ascribed to the clearing of the hills.

Cornish, upon the Connecticut river, reports a shrinkage in ponds and streams of one third, within the remembrance of those now living there. Croydon, adjoining, but farther from the river, is still heavily timbered, and a branch of Sugar river is referred to, which, being fed by several small ponds, has suffered less than other branches of the same river. The ponds and streams of the region have not, however, for many years, been as full as they were once. Sunapee lake, near by, has not been as full as usual for a series of years, and this is associated in part with a diminished rain-fall, and in part, at least, with the rapid removal of the timber in its vicinity.

Crossing now to the opposite section of the state, the town of Durham, we hear the same story of a steadily decreasing supply of both water and woodland.

Take, now, several towns in the lower part of Grafton county. At Hanover the Connecticut river for many years has been decreasing in volume, and with increasing rapidity the timber from its head waters has been floating by. The few and small streams within the town have greatly dried up within the memory of those now living. In Lebanon, the more uniform flow of the Mascoma river is explained by the fact that it is a small and short stream, supplied by the great basin of Enfield pond.

In Canaan, sixty-five years ago, there were nine or more mills of different kinds; abundant water-power all the year round; no thought of reservoirs or double dams, or precautions against drouth. Canaan street, now covered with a firm, dry sod, was laid out through a swamp, impassable but for the hummocks and fallen trees, while dense forests of giant trees covered the hills. The writer who furnishes the above facts, a native of the place, returning after an absence of thirty years, found the hills and rocks bare, the springs choked up, and the mills obliged to resort to steam-power, or lie idle. In Orange, the next town east, a short stream rising on the west side of Cardigan mountain and only four miles in length, which twenty years ago was sufficient to keep a saw-mill running until the first of July, now that the old woods have gone that sheltered its sources, fails a month earlier, although the young growth has begun once more to cover the mountain-sides.

The great mountain region of the state lies in contiguous parts of the counties of Grafton, Carroll, and Coös. The numberless streams originating in this region, protected by the primitive forest, might be thought to be beyond any disturbing causes, but such is not the case. The town of Littleton depends upon the Ammonoosuc for its water-power, but three of its oldest citizens testify that this power has diminished one third within fifty or sixty years. The mountain forests during this same period have been encroached upon as never before, and it is not surprising that so commonly these two facts are associated as cause and consequence.

Carroll county abounds in lakes and forests, but in Moultonborough the water-supply has materially diminished, and so have the forests, while in Chatham, farther north, although the diminution of the streams has not been so marked during the past fifty years, there has been less water. The same is true of other parts of the county.

Coös county contains more of the first growth of timber than any other portion of the state. In the midst of this region are the sources of the Connecticut, Androscoggin, Saco, and their many tributaries, and a diminished water-supply at this point is felt throughout the course of these important streams. The report from Jefferson is, that the older inhabitants agree that the streams are smaller than formerly. An intelligent observer at Berlin, on the Androscoggin river, makes the following important statements, covering a period of twenty-six years. Within a radius of four miles from his residence are eight streams or brooks and two ponds, and the water in each during the above period has materially diminished. As an illustration of the connection between the removal of the woods and this diminished supply, he adds that "six years ago he supplied his stock with water from what was then an unfailing brook, by means of an aqueduct which furnished three hundred gallons per hour. Now that the trees along the stream have been destroyed by the woodman's axe and by forest fires, his water-supply is cut short in summer by drouth, and in winter by frost. Hundreds of acres of timber have been cleared within these six years in the same vicinity."

At Lancaster, the county seat, on the Connecticut river, an old resident reports "an alarming decrease in the water of the streams and springs during the past sixty years, and especially during the last twenty-five years, within which period the smaller timber also has been removed. Israel's river in his boyhood was a large mill-stream eight or ten rods wide, with sufficient water to carry a very large amount of machinery the year round. Now it is an insignificant stream, with, from May to November, not more than half the water it had fifty years ago, and not more than two thirds there was twenty-five years since. Other streams have suffered in the same way, and the springs have, if possible, suffered more than the streams. Many, once thought to be never-failing, are now for long periods dry. That the cutting off the forests accounts very largely for this change he considers as sure as that effect follows cause, and the result is hastened by the reckless methods in use. Instead of cutting timber that is matured, everything is cut to the size of five or six inches in diameter, and what remains is cut into fire-wood, or burned at once, leaving a dreary waste. In Lancaster the timber and wood are nearly all gone, and the mountains are being stripped to their summits."

It may not be entirely out of place to add here the conclusion of this communication, showing in what way a bit of woodland may be made a most valuable addition to a farm. "I have a small tract of timber land," he adds, "of some seventy-five acres, that by judicious cutting will furnish my farm with wood and timber without damaging the lot. I have a sugar orchard of some seven hundred trees, on five or six acres, that is now worth a thousand dollars, and has mostly been grown in forty years. I cleared the land of everything but the small maples, and gave them the benefit of it. And I speak of this to show how much may be done with little cost."

While the statements given above prove beyond doubt the steady diminution of our water-supply, and show what is the commonly received explanation of this state of things, a few of the towns heard from, and these mainly in the southern part of the state, report no very marked variation in the amount of water in ponds and streams for a considerable term of years, and an increase rather than a diminution in the amount of woodland. Much of this woodland, however, is the young growth, brush-wood only, which cannot for years protect the ground from the drying effects of sun and wind, as did the older woods; and besides, from its relatively greater amount of foliage, evaporation proceeds all the more rapidly. That our wooded districts here and there are on the increase cannot, however, alter the force of the facts which confirm the more commonly received opinion as to the general condition of things within our limits. If in any instances the decrease in water-power has been checked or averted, it is all the more important to know how this result has been reached, that the same means may be used elsewhere. In every case this means has been connected with the preservation or the restoration of the forests.

On one point there is no division of opinion. It is not in the open ground, but beneath the trees, that the moisture and the snow accumulate, and are slowly and surely supplied to the springs and streams, which then have a perennial flow. Let the same ground be deprived of its shade, and this exposure to the sun hastens evaporation, and the rain and melting snow rapidly pass off through the water-courses before any sufficient quantity can reach the permanent reservoirs under the surface. The snow on the exposed hillside may be swept off entirely by the wind; and even when any considerable portion remains, much will evaporate, and after all be lost to the soil and the springs. The soil itself is often washed off, and the exposed rocks given over to perpetual barrenness. It is the steady and uniform flow of unfailing streams which the industries of our state require. Alternating flood and drouth are only disastrous. These cannot always be escaped; but the history of large portions of the Eastern continent—once fruitful, now a desert—proves that both are sure to follow the disappearance of the forests. An increased number of storage reservoirs may for a time protect our larger interests; but the time will come when economy will force us to use steam as the cheaper motive power until the centuries shall once more clothe our mountain-sides with forests, and restore our streams. Meanwhile many a smaller industry that cannot afford steam-power must disappear, and the tiller of the ground will more than ever be exposed to dry pastures and uncertain crops. An interesting statement may be quoted here from the N. H. Geological Report (vol. 1, p. 124), that when in the central and southern portions of the state the hay crop has been cut short by drouth, it has been known to be above the average in the northern part, even with less rain-fall, and for the reason that the forests secured a better *distribution* of the results of rain-fall and melted snow. In short, it is the proper *storage* and *distribution* of our water-supply that are of much greater importance to us than the *amount* received.

Passing now to the matter of local climate and rain-fall as connected with the removal of the forests,—the third point of inquiry,—there is too little data on which to form more than a very general opinion. Observations have not been taken for any sufficient length of time at any considerable number of points to furnish means of satisfactory comparison, much less of positive determination. A few answered the question in the affirmative and a few in the negative, but the larger number were not disposed to venture an opinion on the subject.

The tables contained in the Geological Report of our state seem to show that the annual amount of rain-fall in the Atlantic states, from Maine to Maryland, between the years 1805 and 1867, has, on the whole, increased. Records kept at Littleton by Mr. Charles Nourse show that from 1873 to 1883 inclusive (omitting 1875 unrecorded), there was an average precipitation of 36.13 inches, the latter half varying but little from the former half, but including the maximum of the entire period,—40.87 inches in 1881.

Mr. S. D. Lord, of Manchester, furnishes tables prepared by himself and Mr. S. B. Kidder who has charge of the gates at the Amoskeag falls. The periods included are from 1852 to 1861, and from 1875 to 1883. Comparing the records of the summer months, which only are complete throughout these two periods, we have for the first an average fall in June, July, and August of 11.13 inches, and for the second, an average of 7.83, showing a marked falling off during the second period. The remainder of the tables, also, so far as filled out, indicate a falling off throughout the same years, and the more so as they include the dry seasons of 1882 and 1883. It must be noticed, however, that the amount of rain-fall in the southern portion of the state cannot as seriously affect the general water-supply as does the amount distributed throughout the highlands in the centre and upper portions of the state, where are the main sources of our great streams.

Mr. H. A. Hazen, of the Signal Service office in Washington, D. C., adds to what has been given above, the records kept at Stratford, N. H., from 1858 to 1873. The average of rain and melted snow for the latter half of this period is 42.81 inches, as against 39.90 inches for the former half, showing a decided increase, and in a mountain region. Since 1872 the amount of precipitation on the summit of Mt. Washington has been recorded, but the record is rendered somewhat uncertain during the winter by the drifting of the snow. If accepted as in the main correct, the amount of rain and snow, as shown by the past ten years, is on the increase.

The accompanying tables,* selected from those very kindly put at the disposal of the commission, show the variations in rain-fall (melted snow always included) at five different points within the state and one just across the border in Vermont; and they so far cover the same series of years as to invite comparison. The graphical chart, also given, includes in addition the record made in Woodstock, Vt., by Mr. Hosea Doton, for the years 1869 to 1884 inclusive, and enables the reader at a glance to compare the results of what is given in detail in the separate tables. It is deserving of most careful and attentive study.

Do these tables now indicate any uniform and permanent decrease in the amount of rain-fall, as we compare the earlier with the later records?

The observations made at Lunenburgh, Vt., it will be seen, cover a series of thirty-seven years, and give an average of 40.09 inches of rain yearly, between the extremes of 31.14

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*In computing the "mean" of the column of "yearly totals" for these tables, where the record is deficient for a single month, the "total" for the year has been increased by the "mean" for the month omitted. Where several months are wanting, the "total" for the year has not been included in the computation, so that the average given in such cases is not derived from the figures in the column as they now stand.

inches in 1880 and the unusual amount of 60.91 inches in 1872, when more than twelve inches is recorded in the single month of August. Twenty-two of the above thirty-seven years fall below the average, but the larger portion of these years of deficiency are in the first half of the period, and not in the latter half. Again, dividing the series into seven periods of five years (beginning for convenience with 1850), it is the first two periods and the last which fall below the average; the remaining four periods, coming down to 1879 and near the present time, are all above the average, and two of them very much above it. The years 1880 to 1884 inclusive, give an average rainfall of only 34.78 inches, and mark a time of decided drouth.

The average rain-fall at Hanover for the last fifteen years (all that in the table have a complete record) is only 30.05 inches, in striking contrast with the record at Lunenburgh, about seventy-five miles further north. Here, too, the average for the last five years indicates a decisive falling off, but not a falling off suggested of necessity by the two five-year periods that precede. The same statements are true as to the record of observations made at Woodstock, Vt., about eighteen miles from Hanover. The average rain-fall of 36.73 inches drops suddenly to 32.51 inches during the last five years.

At Weirs the annual average for twenty-five years has been 43.12 inches; and here again the average is well maintained, until the dry period from 1880 to 1884 is reached.

At Concord, during the same twenty-five years, the average is 39.17 inches. All but the last of the five-year periods exceed the average, varying from 44.05 inches for the first period to 33.11 inches for the last, and showing a very slight decrease from period to period. The twenty-years record furnished by the late Mr. Tufts, of Dover, is not entirely complete, but as it stands it also shows a gradual diminution of rain-fall, with the same abrupt falling off of the record during the recent years of wide-spread drouth.

If now the above summary correctly represents the bearing of the accompanying tables upon the question of rain-fall within our limited area, there is little to indicate that there has been any considerable decrease in amount aside from the record of the last few years. During these years the decrease has been most extraordinary, not to say alarming; but the previous record, certainly, did very little to forewarn us of its coming. The more natural inference is, that this decrease is exceptional; but whether permanent or exceptional, it forces us to inquire as to the cause or causes. It may not be possible to show by facts and figures, as in the case of our diminished water-supply, that variations in climate and rain-fall also run parallel with changes in our forest area, especially when so large a portion of the state is still covered with woods. Common observation, however, so often connects the two, that even if unable at once to decide the question, we cannot well avoid its thoughtful consideration.

Certain *local* effects are unquestioned, and come under daily observation. Extensive clearings in the vicinity of many of our farm-houses and villages have brought about changes that prove anything but advantageous, adding in many ways to the rigor of our climate, and rendering such localities less desirable for residence than formerly. Trees may not be so much needed by us for shelter and protection as on a Western prairie; but the treeless hilltop or hillside is certainly less favorable for our cattle and our crops, our orchards and our gardens, for health, and even for home comfort, than the same location would be with sheltering belts of timber to break the force of the storm in winter, and to check the drying influence of the wind throughout the year.

We may call these changes local if we will, and believe their effect on atmospheric conditions will be as difficult to determine in the future as in the past; but let these changes go on for a generation or two longer as rapidly as they are now going on, becoming general instead of local, and who doubts their effect on both climate and rain-fall, as well as water-supply? Again: It may be said that the forest area of our state is too limited in any case to have much influence on our climate and rain-fall, since both are controlled by conditions covering a much wider area of territory. But when the woodman's axe is as busy as it now is east and west and north and south of us, we cannot fail to see that injurious changes are coming, greater than any as yet experienced, and that our best, perhaps our only, means of protection against them, as they may still further affect climate, rain-fall, and water-supply, is the more prudent management of our forestry interests.

CONCORD.	DOVER.	WEIRS.	WOODSTOCK, VT.	HANOVER.	LUNENBURG, VT.

TABLE 1.

Amount in inches of monthly Rain-fall (including melted snow) at Lunenburgh, Vt., as recorded by Dr. Hiram A. Cutting.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly totals.
1848	2.68	4.75	3.60	1.12	2.72	1.84	4.20	3.82	1.10	5.84	3.38	5.95	41.00
1849	2.25	3.85	6.10	2.22	2.47	2.00	4.00	1.75	2.20	2.25	3.71	3.00	35.80
1850	2.90	3.95	4.50	2.00	3.50	1.75	3.90	4.00	2.05	4.90	3.50	3.05	40.00
1851	4.00	1.15	3.50	7.10	.85	3.60	4.18	1.25	2.80	3.00	1.50	.57	33.50
1852	2.75	3.75	4.10	5.25	5.80	4.20	2.75	2.00	3.25	3.75	.45	.95	39.00
1853	4.00	4.55	2.10	2.80	3.10	2.80	4.20	4.50	3.15	2.80	4.00	3.75	41.75
1854	4.80	3.90	3.25	2.10	2.20	2.50	1.10	.75	3.75	4.20	4.05	4.00	36.60
1855	1.40	2.25	4.25	3.75	4.70	5.80	3.20	2.50	3.25	2.20	2.00	2.95	38.25
1856	3.25	3.00	5.20	2.10	2.40	3.75	3.75	3.20	3.00	3.15	3.00	4.00	39.80
1857	2.60	2.90	4.50	3.00	2.80	3.25	8.50	3.00	2.95	4.18	2.50	2.07	37.25
1858	3.25	3.00	1.50	4.10	2.50	2.85	2.75	3.50	3.25	3.80	5.00	3.00	38.50
1859	1.07	2.05	4.25	1.25	2.75	4.00	2.25	8.06	4.50	2.50	2.85	4.77	35.30
1860	2.25	2.16	1.98	1.56	1.50	1.06	3.62	9.06	4.52	2.32	5.37	3.50	38.90
1861	3.20	3.00	2.95	5.85	6.75	4.09	6.00	1.75	5.00	4.62	2.18	1.70	47.00
1862	3.80	5.02	3.56	2.40	1.75	1.70	2.75	6.00	4.00	4.00	6.75	4.07	45.80
1863	5.45	1.40	4.70	2.85	4.50	1.50	8.70	2.90	3.05	3.60	2.25	5.10	46.00
1864	2.63	1.88	2.92	1.90	6.85	1.82	2.00	3.30	2.75	6.12	3.70	3.65	39.02
1865	3.85	1.70	5.13	3.35	6.55	2.75	3.92	1.00	4.62	3.35	2.95	1.02	39.69
1866	1.55	3.35	1.40	2.50	2.00	3.00	6.00	5.25	6.00	1.95	3.25	1.85	38.10
1867	2.05	4.30	2.60	2.70	9.47	3.75	8.33	3.75	2.00	1.50	2.45	1.75	39.65
1868	1.87	1.45	2.80	1.30	5.75	4.40	5.05	1.83	8.02	1.30	7.15	2.45	48.37
1869	4.30	4.12	4.45	2.05	2.85	5.00	2.75	2.50	2.60	8.10	2.21	3.02	43.95
1870	4.55	4.00	1.47	2.50	3.60	3.50	4.34	6.42	3.00	3.95	6.52	1.30	45.65
1871	3.15	2.10	3.65	5.72	3.62	2.12	4.35	7.35	2.30	3.90	1.00	3.70	42.96
1872	2.00	3.05	2.70	2.00	8.20	7.33	7.25	12.58	3.48	2.27	5.05	5.00	60.91
1873	3.85	3.35	4.50	2.65	2.64	2.00	3.95	2.50	4.75	5.45	2.22	2.65	40.51
1874	3.70	1.80	2.25	4.05	2.95	7.06	4.98	4.38	1.35	1.15	2.71	3.07	39.45
1875	3.60	4.03	3.00	2.85	3.73	5.70	2.55	3.45	4.35	5.26	2.92	1.40	42.84
1876	3.55	2.60	3.00	2.75	4.70	7.05	5.22	1.35	5.94	1.50	1.67	2.82	43.15
1877	2.15	.65	6.40	2.35	1.05	3.00	4.22	5.95	2.05	4.70	3.65	1.87	38.04
1878	1.65	.80	2.25	6.15	2.45	4.65	3.35	4.45	1.20	2.60	2.70	2.30	34.55
1879	3.45	2.75	3.15	2.70	1.45	5.80	5.00	4.67	3.78	2.20	4.18	4.30	43.43
1880	2.25	2.60	1.47	1.40	3.05	2.30	2.45	3.79	2.40	4.70	2.18	2.55	31.14
1881	2.90	1.70	2.60	1.00	4.55	2.20	3.09	2.75	2.45	4.85	5.19	4.92	38.20
1882	3.75	3.75	1.75	1.55	2.20	4.93	2.85	1.05	5.26	1.45	1.27	2.40	32.21
1883	2.10	3.65	2.40	1.30	4.00	4.34	4.80	1.18	2.90	4.50	2.83	2.60	36.60
1884	3.30	2.30	4.60	1.26	4.45	1.95	2.50	2.55	2.55	5.00	2.50	2.80	35.76
Means.	3.01	2.88	3.34	2.79	3.69	3.53	3.91	3.65	3.39	3.59	3.26	2.97	40.09

TABLE 2.

Amount in inches of monthly Rain-fall (including melted snow) at Concord, N. H., as recorded by Hon. W. L. Foster.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly totals.
1856	......	......	......	2.00	5.14	2.59	2.35	13.82	3.60	2.05	1.02	.92	32.99+
1857	2.75	0.50	1.45	5.69	5 97	3.20	4.81	3.00	2.40	5.12	2.28	2.17	39.34
1858	3.88	1.83	1.29	1.99	3.32	3.96	4.57	4.22	5.97	3 79	1.69	1.32	37.33
1859	3.00	1.17	.87	1.11	......	6.74	3.36	4 39	5.56	2.78	2.90	2.77	34.65+
1860	3.00	1.86	.96	1.50	2.20	3.23	3.10	4.71	3.18	3.18	5.05	2.78	34.70
1861	3.15	.75	3.79	5.23	3.83	1.66	5.61	3.52	3.05	6.86	3.08	2 00	42.53
1862	2.75	1.93	2.62	2.89	2.72	7.95	4.74	3.57	3.12	5.40	7.57	1.74	47.00
1863	3.67	3.38	5.42	3.47	2 52	4.12	6.82	6.35	2.69	5.15	7.06	3.48	54.18
1864	1.11	5.56	4.84	3.72	2.37	.72	1.31	5.71	3.38	4.30	5.75	4.19	41.91
1865	3.79	2.03	4.02	2.61	5.41	2 55	3.76	3.30	2.00	5.01	1.63	2.78	38.89
1866	1.17	3.18	1.97	1.41	3.55	3.14	3 36	3.89	5.03	2.59	4.03	3.19	36.51
1867	1 87	1.92	3.34	3.51	3.85	2 05	4.59	9.90	1.54	3.42	2.38	1.90	40.27
1868	2.89	.98	2.08	2.43	6.81	2.52	3.05	2 89	9.92	.61	6.07	1.55	40.80
1869	2.49	2.54	4.37	1.45	3.18	1.54	1.14	2.01	3.46	11.65	2.18	4.02	40.03
1870	5.70	4.00	2.80	6.23	1.74	2.20	1.40	1 23	1.94	2.17	2.39	2.04	33.84
1871	1.40	2.30	3.61	4.70	3.04	2.47	4.20	5.02	1.30	4.73	2.82	3.23	38.82
1872	1.37	1.43	2.13	1 45	2.49	4.61	7.72	7.00	4.32	4.71	4.80	3.00	45.03
1873	4.37	1 87	2.43	1.92	2.15	.89	4.08	1.85	4.06	6 05	2.73	2.86	35.26
1874	2.99	3.05	.67	4.27	4.19	4.74	6.54	1.95	2.40	1.37	2 28	.78	35.28
1875	2.83	2 28	4.02	3.13	2.77	3.97	2.43	5.31	2.92	6.17	3.03	.95	39.81
1876	3.17	5.33	7.68	2.20	3.22	4.89	4 73	.42	3.82	.95	2.56	3.58	42.55
1877	1.67	.40	5.16	3.26	2.98	2.63	4.77	4.37	.85	7.62	6.18	.80	40.69
1878	3.98	4.00	2.26	6 70	1.86	5.10	1.84	4.06	.71	4.09	5.76	6.32	46.68
1879	2.33	3.16	2.58	2.90	4.51	4.76	4.29	4.39	3.28	.79	2.87	3.64	39.50
1880	4.15	2.38	1.20	2.70	1.63	1.33	3.55	1.47	3.12	3.98	2.01	2.14	29.66
1881	3.19	3 43	3.51	.88	3.28	3.34	4 38	1.25	3.52	2.96	3.32	5.81	38.87
1882	3.84	3.66	2.68	1.02	4 07	3.98	1.73	.35	7.22	1.41	1.02	1.61	32.04
1883	1.73	2.10	1.32	2.32	3.04	2.04	5.80	1.37	1.96	3.67	1.87	2.25	29.47
1884	3 98	4.65	4.18	3.40	3.07	.93	2.14	3.62	.76	2.04	2.77	3.97	35.51
Means.	2.90	2.54	2.97	2.97	3.39	3.23	3.86	3.94	3.84	3.94	3.42	2.68	39.17

TABLE 3.

Amount in inches of monthly Rain-fall (including melted snow) at Hanover, N. H., as recorded at the Dartmouth College Observatory.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly totals.
1864	2.95	2.00	1.89	1.83	1.82	.73	.51+	....	2.61	3 68	3.74	1.79	23.55+
1865	.70+	.50+	......	3.01	1.40	3.31	1.17+	....	2.18	2.82	2.08+	......	17.12+
1866	......	......	.25+	1.59	1.56+	2.97	1.49+	....	3.41+	3.24+	1.53	1.96	18.00+
1867	1.35	1.98	1.14+	1.52+	3.71+	4.04	1 28	4.61	1.89	3.21	1.55+	.78+	27.07+
1868	1.70+	.65	2.42	2.44	6.44	5.43	1.35	3.94	6.47	.33	......	1.46	32.63+
1869	2 05	1.65	4.53	3.45	3.84	3.46	2.67	....	6.13	9.30	.86	1.79	39.73+
1870	5.03	3.44	1.80	2.90	2.58	3.17	1.82	1.13	1.68	3.50	1.59	1.16	29.75
1871	1.74	2.15	2.64	1.63	2.86	2.16	1.24	3.06	1.32	1.89	2.14	2.49	25.32
1872	1.46	1.40	1.62	.40	3.42	4 34	5.64	7.35	2.64	1.57	.75	2.28	32.87
1873	3.10	1.75	3.55	1.32	1.21	1.74	5.91	1.52	3.33	5.57	2.38	1.65	33.53
1874	2.90	1.81	.68	3.40	3.26	3.44	5.07	2.01	3.92	1.30	1.92	1.08	30.79
1875	3.93	1.20	2.55	1.92	3.94	4.98	2.70	4.51	1.94	3.94	1.63	.78	34.02
1876	1.72	3.59	3.46	1.32	1.32	3.46	....	.42	4.58	.53	2.13	4.30	26.83+
1877	2.70	.00	2.57	1 97	1.08	4.28	8.48	4.01	.91	4.67	3.81	.96	35.39
1878	1.93	1.70	.28	3.01	1.99	3.40	2.62	2.44	1.66	1.30	3.51	3.99	26.92
1879	2.85	2.38	3.01	2.52	.81	4.05	2.77	3.46	3.43	1.68	4.59	1.97	33.54
1880	3.18	1.29	1.08	1.65	1.68	1.83	2.39	3.23	2.06	2.84	2.22	1.51	23.96
1881	2.97	1.21	2.02	.62	3.61	....	....	.85	1 92	2.50	2.47	3.96	22.13+
1882	1.66	2.11	.98	.81	3.79	3.05	2.70	1.55	6.46	.77	.59	1.80	26.27
1883	1.07	2.02	1.07	1.31	2.71	2.73	4.30	.85	2.38	2 89	1.88	1.87	24 58
1884	1.96	3.06	3.11	2.29	2.74	2.87	1.66	3.83	.27	1.40	3.45	2 75	29.39
Means.	2.43	1.86	2.12	1.95	2.61	3.27	3.06	2.87	2.93	2.80	2.26	2.08	30.05

TABLE 4.

Amount in inches of monthly Rain-fall (including melted snow) at Weirs, N. H., as recorded by the Winnepiseogee Lake Co.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly totals.
1857	2.02	3 56	2.63	6.26	6.55	3.42	3.38	7.11	1.88	5.29	2.75	4.23	49.98
1858	3.25	1.97	1.76	3.20	3.22	2.38	4.67	4.14	5.05	6.98	2.35	3.58	42.55
1859	5.94	3.02	7.16	3.22	2.20	5.63	2.75	1.71	4.33	2.11	3.87	4.74	46.68
1860	.70	3.62	2.09	1.35	1.94	3.86	5.05	4.24	4.63	3.28	5.74	3.93	40.43
1861	4.97	2.53	2.69	2.86	4.15	2.09	3.70	1.86	3 71	5.19	4.99	2.72	41.46
1862	6.37	3.97	4.99	2.05	2.57	4.41	3.19	4.67	3.65	4.42	6.08	2.90	49.27
1863	5.24	3.72	5.60	4.20	2.42	1.39	8.16	4.56	2.93	3.74	4 98	5.41	52.35
1864	2.83	1.77	4.01	3.41	2.86	.51	.98	4.73	2.89	3.97	5.63	4 64	38.23
1865	4.52	2.26	4.19	4.87	5.35	2.02	4.44	2.40	2.15	3.89	2.14	3.56	41.79
1866	1.80	4.71	3.06	1.57	3.47	3.45	3.75	3.62	5.84	2.40	3.29	3 11	40.07
1867	1.09	3.65	2.98	4.89	4.34	3.74	2.82	6.97	1.18	3.73	2.23	2.13	39.75
1868	2.97	1.12	1.09	2.67	8.16	2.02	4.11	2.99	10.18	.49	6.47	2.05	44.32
1869	3.05	6.68	5.79	2.49	3.71	2.28	2.94	2.71	3 12	11.80	2.04	4.94	51.55
1870	6.23	6.27	4.89	6.39	1.38	1.77	3.39	1.58	1.40	3.96	3.18	1.80	42.24
1871	1.85	2 47	3 84	3.39	4.31	2.41	3.93	3.45	1.83	4.10	4.82	3 57	39.97
1872	1.74	3.76	2.77	1.75	3.28	5.83	2.82	8.22	6 89	2.28	4.89	3.19	47.42
1873	4.78	2.20	3.83	.56	.83	1.95	8.22	1.09	5.22	6.64	3.37	3.20	41.89
1874	2.34	3.70	.84	2.61	4.50	4.00	7.98	2.43	5.62	1.78	3.30	1.29	40.39
1875	3.76	4 90	4.04	2.68	2.85	5.16	2.42	6 62	2.71	6.21	4.22	1.30	46.87
1876	2.94	5.67	9.76	2.77	2.34	5.05	5.52	.36	4.31	.97	2.85	3.70	46.24
1877	2.40	.33	5.11	2 96	1.93	2.86	4 90	4.08	1.20	6.57	7.26	1.45	41.05
1878	4 50	1.88	2.50	5.67	.99	5.76	2.57	4.23	1.35	4.48	5.48	7.38	46.79
1879	2.89	3.33	5.82	2.62	1.46	6.15	3.39	4.37	3.38	1.11	4.12	3.93	42.57
1880	5.23	2.47	1.66	2.68	2.97	2.65	3.28	1 55	2.52	4.67	3 65	2.99	36.32
1881	4.17	3.28	4.76	1.43	3.99	2.76	5.59	3.39	3.13	4.08	3.61	5.76	45.95
1882	3.74	2.85	3.20	1.34	4.77	4.72	1.92	.55	8.09	1.43	.74	2.74	36 09
1883	1.97	3 98	1.41	2.63	3.21	3.27	5.87	1.62	3.34	4.69	2.59	3.11	37.69
1884	2 80	4.87	4.63	3.33	2.94	.80	4.94	4.08	.95	2.42	3.14	3.67	38.57
Means.	3.43	3.38	3.83	3 07	3.31	3.30	4.16	3.55	3.70	4.02	3.92	3.47	43.12

TABLE 5.

Amount in inches of monthly Rain-fall (including melted snow) at Dover, N. H., as recorded by Mr. Asa Alford Tufts.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly totals.
1865	1.8	4.0	3.3	3.5	6.3	2.5	3.3	2.3	2.4	5.8	6.4	2.4	43.50
1866	......	4.5	4.7	2.3	4 7	3.6	3.7	2.9	5.4	2.0	3.2	2.4	39.40+
1867	......	3.6	3.8	3.4	4.7	2.1	3.0	9.7	1.4	3.4	3.4	2.0	40.50+
1868	1.6	.9	1.6	3.9	9.4	3.9	2.0	2.1	9.0	.....	7.8	.8	43.00+
1869	1.9	2.8	6.7	1.4	4.7	2.5	1.0	1.7	3.9	8.6	2.9	3.5	41.60
1870	4.6	3.6	3.4	5.8	3.4	2.1	2.7	1 7	2.0	3.8	3.2	1.2	37.50
1871	1.8	2.6	4.2	4.2	3.7	2.3	3.3	8.9	1.5	5.4	5.0	3.0	45.90
1872	2.0	1.9	......	3.2	2.4	7.6	5.2	10.3	5.0	3.7	4.0	.8	46.10+
1873	2.2	......	2.6	6.3	3.4	1.3	4.8	3.0	4.3	5.9	2.2	2.4	38.40+
1874	2.3	2.5	1.6	4.5	4.8	3.9	6.6	4.2	1.8	.7	2.9	1.3	37.10
1875	......	2.5	2.0	2.8	2.5	6.2	2.5	5.7	3 5	6.4	5.1	1.2	40.40+
1876	2.0	3.3	7.1	2.5	3.7	3.3	4.7	.4	4.5	2.0	3.6	.....	37.10+
1877	......	......	4.1	3.1	2.1	1.7	5.5	4.9	.7	7.1	9.1	.8	39.10+
1878	5.7	2.8	3.2	6.0	1.2	6.1	1.6	2.2	.9	6.1	5.1	6.6	47.50
1879	1.7	2.5	3.6	3.2	.9	4.7	3.8	4.8	1.9	.7	3.6	2.1	33.50
1880	6.4	2.2	1.3	3.3	.5	3.9	5.7	2.1	2.2	3.0	2.2	1.4	34.20
1881	3.3	4.7	4.2	1.8	3.7	3.9	3.3	1.4	3.9	3.6	2.8	6.0	42.60
1882	3.6	2.7	2.6	1.4	4.2	3.2	2.2	.3	6.3	2.2	0.2	1.9	30.80
1883	1.6	2.5	1.0	2.3	3.3	2.9	4.7	.7	2.2	4.3	2.0	3.0	30.50
1884	4.4	3.7	5.1	3.7	3.4	2.4	2.7	3 7	1 3	1 2	3.3	.....	34.90+
Means.	2.34	2.96	3.48	3.43	3.65	3.50	3.61	3.65	3.20	3 97	3.90	2.38	42.05

THE TREES AND SHRUBS COMPOSING THE NEW HAMPSHIRE FORESTS.

THEIR DISTRIBUTION, RELATIVE ABUNDANCE, AND UTILITY.

Originally a dense forest covered our state. There were no "parks" as in the Rocky Mountain region, or "oak openings" and grassy plains as in the valley of the Mississippi; but with the exception of a few sedgy swamps, the work of the beavers, and some favorable spots near the streams where the Indians had established their rude corn-fields, together with those parts of the White Mountains whose elevation above the sea gives them a climate too severe to allow the growth of arborescent vegetation, there were no other breaks in this wilderness,—a body of forest, which, when the white man's axe first began to destroy it, was equal in the variety and quality of its timber to any on the northern part of the Atlantic slope.

Two hundred years has so far changed this, that, instead of possessing a superabundance of the finest timber, the present generation must consider the best methods of conserving what now remains, and can never hope to see in the present young woodlands timber equal in quality to that of the primitive forest. The old growth remains only in parts of the White Mountain district and a few localities elsewhere, which are not easily accessible.

That the evil is not far greater is due, probably, to the fact that the climate of our state is more favorable for the return of a new forest after the old one has been destroyed than that of most countries, and because the railways have rendered it easy to use mineral coal for fuel in the large towns and cities.

The chief of our recent geological survey, Prof. C. H. Hitchcock, in order to get information which might help to solve certain problems in geological science, caused researches to be made concerning the way in which the animals and plants of the state were distributed. As a result, it was found that both the fauna and flora could be separated into two well marked divisons, which, in accordance with the usage of others who had made similar studies, it was thought best to term Canadian and Alleghenian. The dividing line between the two, however, was found to be much more sharply defined in case of the animals than of the plants, owing perhaps to the fact that the animals are able at will to keep within those limits which they find to be most congenial, while the plants spring up wherever the seed happens to fall, and must adapt themselves to the particular locality and conditions, or perish altogether. It is easy to adopt this classification for the distribution of our arborescent vegetation; and the primal cause which places the different species in one division or the other is found to be the altitudes above the sea level at which they appear or disappear.

Certain of our trees, which may be regarded as typical of the Alleghenian flora as it is shown in our state, are found at their northern limit, growing at an altitude which is not far from six hundred feet above the ocean; and the six hundred feet contour may be taken, therefore, all things considered, as best defining the northern limit of this part of our flora. We find, also, on all those elevations in the southern part of the state that rise higher than one thousand feet, that the trees are mostly those species which compose the forests of the White Mountain district and northward, and therefore to be considered of the Canadian type; and the Alleghenian species so rarely reach that altitude that their presence in such localities may be considered exceptional.

As examples of this way of distribution we may name the white oak and the pitch and red pines as characteristic Alleghenian trees, because at the six hundred feet contour they find their northern limit in the Connecticut valley on the west, and at about the same elevation south of the White Mountains on the east side of the state, while near the Massachusetts line they are very rarely seen growing in localities more than one thousand feet above the sea.

On the other hand, that strictly Canadian tree, the arborvitæ, is never found native at altitudes which are below six hundred feet above the sea, except at one place in the Connecticut valley where its southern limit is at the rapids which are not far north of the White river; also the most of the spruce which grows south of the White Mountains along the Connecticut-Merrimack watershed at altitudes not far from one thousand feet above the sea.

It is also not uncommon to find throughout the area which is mostly occupied by the southern types tracts where the flora is largely Canadian, which tends to show that the latter is much the oldest, and has been slowly giving way to the encroachments of those trees which flourish best further south. At first thought it might seem that only those woody plants which grow tall enough to be of some value as fuel need be included in a description of our forest trees; but as it is difficult always to draw the line as to which should be a small tree or a large shrub, and as shrubs are always present in our fields and forests, and so many of them have a direct economic value because of their fruit, and as they must all be dealt with in any scheme of forest culture, either as weeds to be removed to make way for a better growth, or as nurses for the seedlings of the best kinds of timber trees, it is thought best to include them, noting those that are rarest, or of little importance, very briefly. In the following catalogue the species are designated by their scientific and some of their common names, together with brief descriptions and notes of some of their uses.

The authorities followed are Gray's Manual of Botany, and "A Catalogue of the Forest Trees of North America," by Prof. C. S. Sargent, for the tenth census of the United States.

The accompanying table is designed to show the species characteristic of the two divisions of our flora, as well as some which are common to both of them.

Berberis vulgaris, L.

Common Barberry; naturalized from Europe; occasionally within the oldest settled portions of the state. A shrub ten to fifteen feet high, with spiny branches. An excellent hedge plant. The bark and wood yield a yellow dye, and the handsome, acid, scarlet fruit is good for preserving.

Zanthoxylum Americanum, Mill.

Northern Prickly Ash. Rare. At a locality near Nashua it seems to be indigenous, and it has escaped from cultivation in a few places elsewhere. A prickly, low shrub. The whole plant pungent and aromatic. Of use in medicine.

Vitis labrusca, L.

Northern Fox Grape. The species from which most of the cultivated varieties are derived. Common to the alluvial soils and rocky hillsides of the lower Connecticut valley and eastern New Hampshire. The fruit of the wild vine often of good quality.

Vitis æstivalis, Michx.

Summer Grape. Has the same range as the preceding, and is distinguished from it by the leaves' being slightly downy instead of white, woolly beneath, and the fruit about half the size, and usually less palatable. Varieties are sometimes found which are so much better as to show that it would soon improve if cultivated. In the South-western states this is the commonest and best esteemed species.

Vitis riparia, Michx.

Frost Grape, Winter Grape. The most northern species, ranging as far as the foot of Fifteen-Mile falls on the Connecticut. Leaves heart-shaped, slightly three-parted, and smooth, except a few hairs along the veins of the underside. Fruit small, abundant, and of no value until after frost, when it may be useful in localities where better grapes are not to be had. All our species of grape are good types of the Alleghenian flora, rarely being found native above six hundred feet from the sea.

Ampelopsis quinquefolia, Michx.

Woodbine, Virginia Creeper. Well known in cultivation. A handsome, tall, climbing vine, the shining leaflets in fives, and turning bright scarlet in autumn. Fruit the size of pease, bright blue. Common everywhere from the base of the White Mountains southward.

Rhamnus catharticus, L.

Common Buckthorn. A small tree, with hard, reddish or orange-colored wood, and small, nauseous, black berries. It is used for a hedge plant, for which purpose it was introduced from Europe, and it has become well naturalized in the southwest part of the state.

Rhamnus alnifolius, L'Her.

A slender shrub, found in cold swamps. Rare.

Ceanothus Americanus, L.

New Jersey Tea, Liberty Tea, Red Root. A shrub one or two feet high, forming rounded clumps. Flowers white. Dry sterile soils; eastern New Hampshire and near the Connecticut, north to Bellows Falls. The leaves have sometimes been used as a substitute for tea.

Celastrus scandens, L.

Wax-work, Climbing Bitter-sweet. A twining shrub common near the Connecticut and Merrimack rivers. The orange-colored pods open and display the scarlet fruit, and these remain all winter. Often cultivated for ornament, and reputed to be medicinal.

Staphylea trifolia, L.

A handsome shrub, sixteen feet high. Leaves in threes, and the bark striated with green. Because of the inflated pods it is called Bladder-nut. Only rarely to be met with, chiefly in the lower Connecticut valley.

Tilia Americana, L.

American Linden, or better known as Basswood. A large tree, to be met with in all parts of the state, from the sea to altitudes two thousand feet above it. In the southern part of the state it is found most abundantly near the streams, and when found on high lands, prefers a moist, fertile soil. It is commonest and best developed in the upper Connecticut valley, where specimens are often met with which are eighty to one hundred feet in height, with a diameter of from two to four feet.

Bark very tough and strong, owing to its very coarse fibres, and can therefore be used for making coarse matting. Wood very soft, light, and elastic; useful for lumber, a good material for carving, and remarkable for the facility with which it can be moulded into various curved forms, and therefore much in demand for carriage-work. As bees derive an abundance of the best of honey from its flowers, it is recommended by apiarians, as a profitable investment, to plant it as a source of honey. It is of very rapid growth; its abundant foliage makes it very desirable as a shade-tree. It matures in from fifty to one hundred years, but becomes of sufficient size for timber in twenty or thirty. Wood of little value for fuel, but the ashes very rich in potash.

Rhus, Sumach.

Rhus typhina, L. Slaghorn Sumach. The largest of the genus which grows in New Hampshire. A shrub ten to twenty feet high, with wide-spreading branches, the tips of which are covered with velvety hairs, which causes them to resemble the young horns of deer. Common everywhere up to two thousand feet altitude. Flourishes best in moist, rocky situations, and sometimes attains a diameter of ten inches. The orange or yellowish-green colored wood capable of taking a good polish, and useful for small cabinet and ornamental work.

Rhus glabra, L. Smooth Sumach. Six to ten feet high, with smooth branches and leaves, and very large heads of fruit. Stem rarely more than two inches in diameter. This species is seldom seen on the highlands, but is common to the eastern part of the state and the lower Connecticut valley.

Rhus copallina. Dwarf Sumach. Usually four to six feet high, with the shining leaves winged along the petioles. Ranges with *R. glabra*. The leaves of this and the two preceding species are gathered in Virginia for tanning purposes. Perhaps the same use might be made of our sumachs, unless our season is too short for the best development of the tanning principle.

Rhus venenata, D. C. Poison Sumach. Often called Dogwood, a name which properly belongs to *Cornus*. Common in the swamps and moist places of the southern part of the state. A handsome species ten to twenty feet high, with dark green, shining leaves, and slender racemes of white fruit. Wood in color similar to that of the Staghorn Sumach. This species is extremely poisonous to the touch to the majority of people, causing painful swellings and watery blisters on the skin of the parts which come in contact with it, and some are so extremely sensitive to its effects as to be poisoned if they stand within a few feet of it when the air is hot and moist. Others, on the other hand, can handle it, and even chew the leaves, with impunity, feeling no ill effects whatever. The milky juice is said to have properties similar to that of the lacquer tree of Japan, *R. vernicifera*.

Rhus Toxicodendron, L.

Poison Ivy, Poison Oak. A creeping and climbing shrub everywhere well known and common. Fruit white, and leaves in threes. Poisonous like the preceding, but in a less degree. The climbing variety, the *R. radicans* of some botanists, is not very common here, being sometimes seen clinging to the trunks of trees and rocks, and becoming ten or fifteen feet high, with a stem an inch or two in diameter, but in the Mississippi valley it reaches the tops of the tallest trees, with a stem four to six inches in diameter.

Acer saccharinum, Wang.

Sugar or Rock Maple, the finest and most useful of the maple genus. In New Hampshire it is most abundant as a highland tree, and a characteristic of the Canadian division of our flora. It is least common in the south-eastern part of the state, and when found indigenous to Hillsborough and Rockingham counties, it is in moist, rocky places, where the conditions of the soil resemble the slopes of the highlands further north and west. It is a common tree throughout Cheshire, Sullivan, Grafton, and Coös counties; a source of revenue because of its sugar, and the standard wood for fuel. It yields lumber which is very hard, heavy, susceptible of a fine polish, and is much used in chair-making and cabinet work, but is only moderately durable when exposed to the weather. Isolated specimens occur which have the peculiar grain known as "bird's-eye maple," so much prized as an ornamental wood. There is a variety known to the farmers as "black sugar maple," which differs somewhat from the ordinary form in botanical characters. When at maturity in the forest, the rock maple attains a height of seventy or eighty feet, with a diameter of from two to four, but in the open land forms a many-branched, rounded, or oblong head, with a short, stout trunk. Foliage brilliant yellow and orange in autumn. This maple is one of the most ornamental and popular of deciduous shade-trees, matures in about one hundred years, but grows rapidly enough to be valuable for fuel, timber, and shade in twenty or thirty. Although this tree is entitled to a place in the first rank in economic forestry, it is too much neglected, and there are few attempts to replace the old sugar camps preserved by the first settlers.

Acer rubrum, L.

Red or Scarlet Maple, but almost universally called "White Maple" by the farmers and lumbermen of New Hampshire. A good sized tree, so universally distributed over the state, from the sea to two thousand feet altitude, as to be at once recognized as the most common of our maples. Flourishes in all soils and situations from swamp to rocky hillside. Wood far more durable than that of other maples, lasting a long time unless driven into the ground as posts or stakes. Not as hard as that of the preceding species, but takes a good polish, and is used for the same purposes. "Curled maple," the variety with wavy grain, is derived from this species. It is of rapid growth, has a height of from forty to sixty feet, and, owing to the brilliant colors of the foliage in autumn and the red flowers in spring, is the most notable deciduous tree in our forests.

Acer dasycarpum, Ehrh.

White, Soft, or River Maple. A tree sometimes sixty or seventy feet in height, and four or five feet in diameter, although usually not more than forty or fifty, with a diameter of twelve or eighteen inches. A graceful tree, with deeply cut leaves, ripening its fruit the earliest of any of the maples. With us it is closely confined to the banks of the larger streams, and therefore forms a small proportion of our forests. It has soft wood, is of very rapid growth, and the maple so largely used to plant on the prairies west of the Mississippi.

Acer Pennsylvanicum, L.

Striped Maple or Moosewood, and *Acer spicatum*, L., Mountain Maple, are large shrubs or small trees common to our highland woods, the latter especially abundant along the sides of mountain brooks. Both are valuable for ornamental planting, but of too small size to serve for anything else but fuel.

Robinia pseudacacia, L.

Common Locust. A valuable timber tree with us, naturalized from the South or West. It does best in moist, alluvial soils, but in this latitude it is so subject to the attacks of borers as to greatly injure its wood and make the tree so short-lived that it is not worth while to give it much attention as a forest tree, which is to be regretted, as the timber is hard, elastic, and exceedingly durable. It is with us a middle-sized tree, but in the South becomes sixty or eighty feet high, with a diameter of three feet.

Prunus Americanum, Marshall.

In this state called Canada Plum or Pomegranate. A small tree, probably introduced from further westward for the sake of the red or orange-yellow fruit, which is sometimes very sweet and pleasant, but usually so acid as to be best adapted for preserving. It is now well naturalized in most parts of the state, especially in Coös county. This species is probably capable of great improvement as a fruit-tree, but as yet has been almost wholly neglected by the experimental fruit-grower.

Prunus Pennsylvanicum, L.

Red or Bird Cherry. A small tree, thirty or forty feet high, sometimes a foot in diameter. Everywhere common, but seldom large enough to be of any use except for fuel. It springs up most abundantly where woodlands have been wholly cleared away, and seems to be of use in shading the ground until more valuable trees can take root.

Prunus Virginiana, L.

Choke Cherry. Is most common near streams up to one thousand feet altitude, and conspicuous for its handsome but very astringent fruit. Sometimes attains a height of twenty or thirty feet, and large enough for firewood, but sprouts so vigorously as to be a pest where more valuable timber is desired.

Prunus pumila, L.

Dwarf Cherry. A low, trailing shrub on the sandy shores of the Connecticut and Merrimack rivers, and probably other of the larger streams. The abundant, handsome, dark-red fruit insipid and worthless.

Prunus maritima, Wang.

Beach Plum. A low, straggling shrub, common to the seashore and isolated localities inland as far as Manchester. Fruit dark purple, sometimes an inch in diameter, valuable. This species, like the Canada plum, is worthy of experiment for its fruit.

Prunus serotina, Ehrh.

Black Cherry. A tree often sixty to eighty feet high, with a diameter of two or three feet, the hard, reddish-colored wood taking a high polish, and yearly becoming more valuable for the making of fine furniture, finishing the interiors of houses, railroad cars, etc. It does not form extensive tracts of woodland by itself, but may be frequently met with among all species of deciduous trees and in a great variety of soil in all parts of the state below two thousand feet above the sea. The cherry grown in New England is harder to work than that from the Mississippi valley, but it is darker colored, and takes a much higher polish. As cherry lumber brings readily from thirty to sixty dollars per one thousand feet, and is of very rapid growth, it cannot fail to prove an excellent species for planting, the only objection being that it is the host of the tent caterpillar; but the danger to fruit-trees from this source is probably exaggerated.

Spirea saticifolia, L.

Meadow Sweet, White Hardhack. Common everywhere south of the White Mountains in moist lands. A showy plant, but of no utility.

Spirea tomentosa, L.

Red Hardhack, Steeple-bush. Has the same range as the preceding, but not usually so abundant. Flowers pink, showy.

Rubus odoratus, L.

Purple Flowering Raspberry, Mulberry. A handsome shrub, with large three- to five-lobed leaves and large purple flowers. Grows in moist, rocky woods. Common to the northern parts of the state and the Connecticut valley. Fruit of no value, but the plant worthy of cultivation for ornament.

Rubus strigosus, Michx.

Wild Red Raspberry. Well known everywhere, but is best developed in the White Mountain region and northward. It forms dense thickets in forest clearings, and the abundant fruit is picked and sold in town and city.

Rubus occidentalis, L.

Black Raspberry, Thimbleberry. The black-cap raspberry of cultivation. It propagates itself from the tips of the long, recurved shoots. It is more southern in its range than the preceding, and much less abundant.

Rubus villosus, Ait.

High Blackberry. Much more bushy than the two preceding, and freely armed with stout, recurved prickles. It varies in height from a few inches to five or six feet, and each kind of bush seems to represent a different variety of fruit. It is common in most places from the outlet of Umbagog lake and Wells river southward. The fruit abundant, most of it good quality, and much in demand. Like the red raspberry, it flourishes best where woods have been cleared away.

Rubus Canadensis, L.

Low Blackberry, Dew Berry. Connects with the smallest forms of the preceding. It is a low, extensively trailing, very bristly shrub, common to the upper terraces of the streams and dry hillsides. Fruit abundant and well flavored. Ripe earlier than that of the high blackberry.

Rubus hispidus, L.

Evergreen, Swamp Blackberry. Common to damp, highland woods. It has very slender, trailing stems, evergreen leaves, and small, spicy, sour fruit.

Rosa, L., Rose.

The rose genus in New Hampshire is represented by three native species, all Alleghenian.

Rosa Carolina, L. Swamp Rose, is the largest and is most abundant in the eastern part of the state, being only sparingly found in the lower Connecticut valley. It grows three or four feet high, forming thickets in swamps and low ground.

Rosa blanda, Ait. Smooth Rose. Grows in dry, sterile soils, and is usually only a few inches high. The earliest flowering species.

Rosa lucida, Ehrhart. Shining Rose. A slender, few-flowered species, with shining leaves. In moist, shady soils; not very common.

Rosa rubiginosa, L. Sweet Briar. Naturalized from Europe, and is common in old pastures in many parts of the state.

Cratagus coccinea, L.

Scarlet Fruited Thorn. A low, bushy tree. Common to the Merrimack valley and eastward. Fruit ovoid, a half inch in diameter; bright red.

Cratœgus Crus-galli, L.

Cockspur Thorn. Frequent throughout the state up to two thousand feet altitude. It is, however, most abundant on the highlands. Sometimes has a diameter of six inches, and a height of twenty-five feet. Fruit smaller and not so deep red as that of the preceding. The wood of the thorn is yellowish-white, very hard, and heavy; takes a high polish, but is too difficult to work to be of much use. Both species are well adapted to hedge planting.

Pyrus arbulifolia, L.

Choke Berry. A slender shrub, common to moist grounds. The abundant flowers white or tinged with rose, and the handsome black or purple fruit so astringent as to be worthless.

Pyrus Americana, D. C.

American Mountain Ash. A small tree with pinnate leaves, and a bushy habit. It bears a profusion of white flowers, followed by the bright red fruit, and is well known as an ornamental tree. The common pear can be readily grafted into it, and flourishes well for a while. It is a highland tree, common to the Connecticut-Merrimack water-shed, and very abundant on the sides of the White Mountains, where it sometimes becomes a foot in diameter and thirty feet high.

Amelanchier Canadensis, T. and G.

Shad-bush, Wild Sugar Pear, or Service-berry. The first name given because it blossoms when the shad first begin to ascend the rivers. This species presents several well marked varieties, the largest of which, the *var Botrypium*, becomes a small tree, twenty or thirty feet high, and from six to ten inches in diameter; the wood solid, heavy, and susceptible of a good polish, but probably never used for anything except fuel. The variety *oblongifolia* bears the largest and best-flavored fruit, and is a tall shrub, growing in moist soils usually. The *var oligocarpa* is the sub-alpine White Mountain form. In England the fruit of the shad-bush is said to much improve by cultivation, and doubtless something can be made of it by the pomologist.

Ribes Cynosbati, L.

Prickly-fruited Gooseberry. Common to the highlands, and the most widely distributed of our gooseberries. A shrub three or four feet high; the fruit well-flavored, but usually covered with spines.

Ribes hirtellum, Michx.

Smooth-fruited Gooseberry. Merrimack and Connecticut river valleys, and eastward to the coast. A smaller shrub than the preceding, with smooth, purple, sweet fruit. This species is worthy of trial for cultivation.

Ribes lacustre, Poir.

A low, prostrate species, with much-divided leaves, and black, currant-like, insipid fruit. It is common to the sub-alpine region of the White Mountains, and northward.

Ribes prostratum, L'Her.

Fetid Currant. Skunk Currant. A low, half-trailing shrub. The leaves, flowers, and fruit give out an unpleasant odor, but the fruit is not unpleasant tasted. It is common to moist highland woods, and extends to the timber line in the White Mountains.

Ribes rubrum, L.

The Garden Currant is native to the White Mountain region and northward.

Hamamelis Virginica.

Witch Hazel. A large shrub or small tree, everywhere common. It generally throws up several stems from the same root, which are sometimes three or four inches in diameter. Wood white, close grained, taking a good polish; useful for handles for small tools, and excellent for fuel. Bark medicinal. Remarkable for flowering when the leaves are falling.

Cornus Florida, L.

Flowering Dogwood. The largest of the genus, being a tree sometimes twenty or thirty feet high, and six inches in diameter; branches grey, wood dense, heavy, very close grained, and taking a brilliant polish, and is said to be a good substitute for boxwood. The heads of flowers are surrounded by a large involucre, which makes it very showy. Fruit bright red. It is very ornamental, but seldom seen in cultivation. In this state its range is limited to the south-eastern part, and very near to the Connecticut river as far north as Brattleboro', Vt.

Cornus circinata, L'Her.

Round-leaved Dogwood. Stems one or two inches in diameter; four or six feet high, with greenish warty-dotted branches. Leaves large, nearly round, and woolly beneath. Fruit light blue. Connecticut river valley; most common northward.

Cornus sericea, L.

Silky Cornel. Stems slender; few-branched, striated with red and brown, one or two inches in diameter, and five to ten feet high. Common near streams up to one thousand feet altitude. Fruit pale blue, and leaves silky beneath.

Cornus stolonifera, Michx.

Red Osier Dogwood. Upper Connecticut valley and White Mountain region. A handsome species, forming large clumps by sending up an abundance of bright red, purple, osier-like shoots, three to six feet high. It spreads freely by subterranean suckers. Fruit lead-color.

Cornus paniculata, L'Her.

Panicled Cornel. Shrub four to six feet high, with grey branches. Grows on dry grounds, and ranges nearly with the flowering dogwood. Fruit white.

Cornus alternifolia, L.

Alternate-leaved Cornel, Dog-ackerme. Everywhere common in moist woods. Next to the flowering dogwood in size, being sometimes twenty feet high and four or five inches in diameter; branches wide-spreading from near the top, giving it a flat head. Fruit blue. All the cornels are worthy of a place in a collection of ornamental shrubs, both because of the flowers and fruit.

Nyssa sylvatica, Marshall.

Hornbeam, Sour Gum, Pepperidge, or Tupelo. A tree sometimes sixty or seventy feet high, with a diameter of from eighteen inches to three feet, and stiff, angular branches. It usually grows in swamps, and in moist, low lands. It is most common in the Merrimack valley, and seldom seen north of the White Mountains. Wood remarkable for its spiral grain, which renders it unwedgeable. It is seldom used in the axle arts, but if not too soft its non-splitting property would make it a good material for wagon-wheel hubs. It has been thought equal to holly as a cabinet wood, by those who have experimented with it.

Lonicera parviflora, Lam.

Small Honeysuckle. A half-climbing shrub, with the smooth leaves joined together at the base, and greenish-yellow flowers. Found sparingly along the Connecticut and its largest tributaries.

Lonicera cilliata, Muhl.

Fly Honeysuckle. A straggling shrub three or four feet high, with pale yellow flowers and red fruit. Common in rocky highland woods and northward.

Lonicera cœrulea, L.

Mountain-Fly Honeysuckle. Common in moist grounds on the Connecticut-Merrimack water-shed, and in the alpine ravines of the White Mountains, and northward. A half-trailing shrub, forming matted tufts. Flowers straw-color, and fruit blue.

Diervilla trifida, Mœnch.

Bush Honeysuckle. A low, upright shrub, with ovate, taper-pointed leaves, and honey-colored flowers. Fruit a dry capsule. Common everywhere in rocky places.

Sambucus Canadensis, L.

Common Elder. A shrub five to ten feet high, with soft-wooded stems, remarkable for the size of the pith they contain. It is everywhere common. Flowers white. Fruit juicy, black-purple, very abundant, and used to make a medicinal cordial.

Sambucus pubens, Michx.

Red-berried Elder. Grows larger and more tree-like than the preceding species, and is sometimes fifteen feet high, with a diameter of three or four inches; pith brown, and the flowers often purple tinged. Berries bright red, making the plant very showy. This is a highland species, common northward, but seldom seen from the Merrimack valley eastward.

Viburnum Lentago, L.

Sweet Viburnum, or Sheep-berry. A large shrub or small tree, Alleghenian in range, and seldom seen above six hundred feet altitude. The leaves are ovate, sharp-pointed, thick, and shining. Flowers white, as are those of all the Viburnums. Fruit in large bunches, bright blue, edible. Wood hard and heavy, brown; takes a fine polish.

Viburnum nudum, L.

Withe Rod. Stems slender, sometimes two inches in diameter, and six or eight feet high. Grows in clumps, and is everywhere common in wet lands. Fruit blue. Wood gives out a disagreeable odor when burned.

Viburnum dentatum, L.

Arrow Wood. Leaves broad ovate, sharply toothed. Stems slender, very straight, with pale-grey bark. Grows in large bunches, and found everywhere in bogs and very wet places. This species was used by the Indians for the shafts of arrows.

Viburnum acerifolium, L.

Maple-leaved Viburnum. A slender shrub, with three-lobed leaves. Common on the highlands among deciduous trees. Fruit red, turning purple when fully ripe.

Viburnum Opulus, L.

High Cranberry Bush. Shrub five to ten feet high, with light-grey bark. Strongly three-lobed leaves, and bright-red acid fruit, which is often used as a substitute for cranberries. The snow-ball tree of cultivation is derived from this species. Common from the base of the White Mountains northward.

Viburnum lantanoides, Michx.

Hobble Bush. A low, straggling shrub, the reclining branches often taking root. The leaves are broad ovate, heart-shaped, rusty-scurfy beneath, as are also the tips of the branches. Flowers handsome, in broad, flat cymes. Fruit at first dull red, then black. Common in moist woods everywhere, but especially so northward.

Cephalanthus occidentalis, L.

Button Bush. A coarse, smooth-leaved shrub, growing on the borders of ponds and slow streams in the lower Connecticut valley and eastern New Hampshire. Flowers greenish-white, in globular heads.

Gaylussacia resinosa, T. & G.

Common Huckleberry. A slender, much-branched shrub, one to three feet high, forming a close undergrowth in dry pine woods, etc. Common to eastern New Hampshire, ranging as far as the base of the White Mountains. Only sparingly found in the lower Connecticut valley, rarely reaching to elevations one thousand feet above the sea on the southern highlands. Fruit usually black, sweet, and pleasant, ripe in August, and extensively gathered and sold.

Vaccinium Oxycoccus, L.

Small Cranberry. A very slender, trailing shrub, with white, spotted berries, the size of pease. Chiefly in peat-bogs of Coös county.

Vaccinium Macrocarpon, Ait.

Large Cranberry. The well known species whose fruit is extensively sold in the markets. Trailing, like the preceding, but a larger plant. In peat-bogs and moist ground of all parts of the state south of the White Mountains.

Vaccinium Vitis-Idœa, L.

Cow Berry, Mountain Cranberry. A low, tufted and matted evergreen, common to the alpine White Mountain region, also rarely at the sea-coast. Fruit small, red, abundant, resembling in flavor and used for the same purpose as cranberries.

Vaccinium uliginosum, L.

Bog Bilberry. A dwarf, tufted, alpine species, with black, sweet berries.

Vaccinium cœspitosum, Michx.

Same *habitat* as the preceding, growing in small tufts. Fruit large, excellent.

Vaccinium Pennsylvanicum, Lam.

Dwarf Blueberry, Low Blueberry. Six inches to two feet high, usually forming straggling masses in dry woods and old fields. Common, and well known throughout the eastern and southern parts of the state. Seldom seen north of White river in the Connecticut valley. Fruit abundant, blue or black. The earliest blueberry of the markets.

Vaccinium Canadense, Kalm.

Canada Blueberry. A straggling shrub, stouter than the preceding, which it resembles. Leaves and branches downy. Berries often oval, blue, somewhat acid. Upper Coös county; probably never seen in the markets.

Vaccinium vacillans, Solander.

Half-high Blueberry, Sugar Blueberry. Two or three feet high, with upright, slender, yellowish-green branches. Fruit harder, and keeping longer than that of any other species; usually very round, bright blue, and spicy. It has the most limited range of any of our blueberries. It is common in the Merrimack valley, and sparingly found very near the Connecticut river as far as the rapids near the mouth of White river.

Vaccinium corymbosum, L.

High Blueberry. A shrub ten or fifteen feet high, with stems sometimes two inches in diameter. It grows in moist lands and swamps, from the sea level to North Conway, on the eastern side of the state, and along the southern highlands as far as Westmoreland. The wood is hard and very close-grained, useful for the handles of small tools. This species yields the greater part of the blueberry crop, which is yearly sent to the large towns and cities from New Hampshire. No attempts have been made to cultivate it, although it doubtless could be.

Arctostaphylos Uva-ursi, Spreng.

Bear Berry. A matted, trailing shrub, with insipid red berries. The evergreen leaves used in medicine. Eastern New Hampshire, and north to the White Mountains. Not very common.

Cassandra calyculata, Don.

Leather Leaf. A low, many-branched shrub, with brownish-green, leathery leaves, and one-sided racemes of small white flowers. Fruit a dry capsule. Forms dense masses in bogs, and along the shores of ponds.

Cassiope hypnoides, Don.

An alpine, trailing shrub, with moss-like leaves and handsome white flowers. Stems only two or three inches high. Probably the smallest shrub in America.

Andromeda polifolia, L.

A handsome little evergreen shrub, rarely found in peat-bogs. Flowers large, white or purple tinged. Leaves with revolute margins; white beneath.

Andromeda ligustrina, Muhl.

Male Blueberry, Stagger Bush. Shrub three or four feet high, with yellowish bark. In the same situations and much resembling the high blueberry, but the fruit a dry, globular pod instead of a berry. Sometimes poisonous to cattle.

Clethra alnifolia, L.

White Alder, Sweet-pepper Bush. Shrub five to ten feet high, upright. Leaves wedge-shaped, smooth, and sharply-toothed. From the lower Merrimack valley to the coast. In August bears a profusion of bright white, very fragrant flowers. Very ornamental, and recommended to plant for bee-food.

Phyllodoce taxifolia, Salisb.

A small, evergreen, alpine shrub, with linear leaves, and large, handsome, urnshaped, purple flowers.

Kalmia latifolia, L.

Spoon-wood, Spoon-hunt, or Mountain Laurel. A much branched and contorted shrub, four to fifteen feet high, with broad, lance-shaped, evergreen leaves, and bearing a profusion of large white or rose-colored flowers, stems sometimes four inches in diameter. Wood hard, heavy, and close-grained. Grows in swamps and moist, rocky woods, and is very ornamental, but makes an undergrowth very difficult to walk through. It is found in the Connecticut valley as far as Westmoreland,

and in the Merrimack, a little north of Concord and eastward to the coast; also on the highlands south of Monadnock.

Kalmia angustifolia, L.

Sheep Laurel, Lamb Kill. A slender shrub, with oblong, evergreen leaves, which are pale beneath, and bears a profusion of small, deep rose-colored flowers. Has the same range as the preceding, and is poisonous to sheep.

Kalmia glauca, Ait.

Pale Laurel. Stems slender, straggling, eight to ten inches high; leaves oblong, white beneath; flowers few, lilac-purple; sub-alpine and in peat bogs; rare.

Rhododendron viscosum, Torrey.

Swamp Honeysuckle. Shrub four to ten feet high; in swamps near the coast. Flowers white, fragrant, showy, and at the base of the corolla covered with viscid hairs.

Rhododendron nudiflorum, Torrey.

Purple Azalea, June Pink, Election Pink. Shrub two to ten feet high; in swamps and moist ground. Eastern New Hampshire, the highlands around Monadnock, and along the Connecticut to Windsor, Vt. Often cultivated for the very showy, fragrant, pink flowers.

Rhododendron maximum, L.

Great Laurel. A shrub eight to fifteen feet high, the broad, wedge-shaped, evergreen leaves six to ten inches long. Stems two to four inches in diameter. Wood hard and fine grained. Flowers large and very showy; rose color, turning white. Swamps. Local in this state at Richmond, Fitzwilliam, near Manchester, etc.

Rhododendron Lapponicum, Wahl.

Lapland Rose Bay. High alpine. Forms broad, carpet-like masses. Leaves oval, an inch long, rusty dotted and scurffy. Flowers very handsome, deep purple.

Rhododendron Rhodora, Gmelin.

Wet woods and swamps. Southern part of the state, and reaches an altitude of two thousand feet above the sea on Monadnock. An upright shrub, two or three feet high. Stems slender, and bearing abundant, large, rose-purple flowers.

Ledum latifolium, Ait.

Labrador Tea. A low, evergreen shrub, with white flowers, and the leaves brown, woolly beneath. Sub-alpine; White Mountain region, and rarely in cold bogs in other parts of the state. *L. palustre*, a species much resembling it, has been found in the extreme north part of the state.

Loiseleuria procumbens, Desv.

Alpine Azalea. A low, matted evergreen, with small, pink flowers; forming carpet-like masses on rocks in the alpine region of the White Mountains.

Ilex verticillata, Gray.

Black Alder, Winter Berry. An upright, slender shrub, the abundant, bright-red fruit growing close to the branches, and persistent long into the winter. Wet grounds. Everywhere common.

Ilex lœvigata, Gray.

Smooth Winter Berry. Similar in habit to the last, but the lanceolate leaves shining above, and the larger berries on short stems. Swamps and borders of ponds; southern part of the state.

Nemopanthes Canadensis, DC.

Mountain Holly. A many-branched shrub, six or eight feet high. Bark light grey. The showy, deep-red fruit on long, slender stems. Very abundant on the highlands and northward, but common to all parts of the state.

Fraxinus Americana, L.

White Ash. One of the most widely distributed and valuable of our forest trees, but nowhere occurring in large quantities. It grows in a great variety of soils, but attains its best development in a strong, rocky soil, along with beech, birch, and maples. Although its wood is not so heavy as that of the European ash, it is superior to it in strength and elasticity, and endures exposure to the weather moderately well. It is so well known, and adapted to so many different uses, such as carriage making, the handles for agricultural implements, oars for boats, etc., that it is becoming scarce and more valuable each year. It is of such rapid growth that it is one of the best trees for planting, either for fuel or timber.

Fraxinus pubescens, Lam.

Red or Downy Ash. Alluvial soil in the Merrimack valley as far north as Boscawen. A smaller tree than the white ash, which it much resembles. Not abundant enough to be of much value.

Fraxinus sambucifolia, Lam.

Black or Brown Ash. A medium-sized tree, common to swamps and wet lands throughout the state, but most abundant south of the White Mountains. The old growth yields lumber much used for interior finishing and cabinet work. The easily separated layers of the young trees are very tough, and used for coarse baskets and hoops, bands for baling hay, etc. The wood is hard, and considered good for fuel, but not very durable when exposed to the weather.

Platanus occidentalis, L.

Buttonwood, Sycamore, or Western Plane-tree. Occurs in the Merrimack valley toward the coast, and along the Connecticut as far as Westmoreland. Generally found very near the streams, and much more abundant formerly than now, as this species, although vigorous enough in the Mississippi valley, seems as if falling into decay and gradually disappearing from New England. It is a large and handsome tree. The outer bark flakes off in large scales, and shows the white inner bark, thus giving the surface a peculiar mottled appearance. The wood is moderately hard; said to be of value for cabinet work, but does not bear exposure to the weather. It is easily cultivated, and bears the dust and smoke of cities better than most trees.

Sassafras officinale, Nees.

Sassafras. A tree usually twenty or thirty feet high. Branches irregular. Leaves dark green, entire or lobed. Flowers greenish-yellow, and the fruit blue. Lower Merrimack valley, eastward to the coast, and along the Connecticut valley to Bellows Falls. Wood aromatic, durable, but not usually large enough to be of much use, the bark aromatic and medicinal.

Lindera Benzoin, Meisner.

Fever-bush, Spice-bush. A slender shrub, four to six feet high, with ash-grey bark. Leaves oval, dark green. Fruit red. Whole plant aromatic. It has the same range as the sassafras.

Dirca palustris, L.

Leatherwood, Wicopy, or Moosewood. A stout, much-branched shrub, with yellowish bark, the yellow flowers appearing before the leaves. Bark exceedingly tough, and employed by the Indians for thongs. Grows on rich, moist hillsides, and is sometimes cultivated for ornament.

Ulmus Americana, Willd.

White Weeping or American Elm. One of the largest and most imposing of our forest trees, never forming groves by itself, yet common from the sea to the base of the mountains. The finest specimens grow in the rich alluvium of the river valleys, and it has been more largely planted along the streets of the cities and villages than any other tree. The wood is light, strong, and tough, with the fibres interlaced; difficult to season without warping, yet it is much used for the naves of carriage wheels, the woods for brushes, ox-yokes, etc. It is a very heavy feeder, and consequently of rapid growth, and its ashes are said to yield more potash than those of other trees.

Ulmus racemosa, Thomas.

Cork Elm. Rare; occurs at Meriden and one or two other places. It is common from western New York to the Mississippi.

to the hills in the immediate vicinity of the river, extending up the tributary streams a short distance, and disappears entirely before reaching the mouth of the Passumpsic

Quercus bicolor, Willd.

Swamp White Oak. A large-sized, very rough-barked, valuable species, growing in low, moist ground throughout eastern Massachusetts; occurs in the Merrimack valley as far as the mouth of the Souhegan, and probably extends throughout Rockingham county.

Quercus obtusiloba, Michx.

Post Oak. A smaller tree than the white oak, which it resembles in appearance and in the quality of its wood; is said to be found in the extreme south-east part of the state.

Quercus Prinus, L.

Rock Chestnut Oak, Mountain Oak. A medium-sized tree. The wood strong and durable, and considered excellent for railroad sleepers. Occurs in belts or patches in the eastern part of the state, as at Amherst and Milford. In the Connecticut valley it barely reaches our limits on the hills of the south part of Winchester and Hinsdale.

Quercus Prinus, *var. humilis*, Marsh.

A dwarf species, making thickets on the sandy plains of the lower Merrimack, and eastward to the coast. Wood too small to be of value.

Quercus ilicifolia, Wang.

Barren or Scrub Oak. Has the same range as the last, and also appears along the lower Connecticut. A much branched and contorted shrub, six to fifteen feet high, forming dense thickets; very difficult to eradicate, and impeding the growth of better timber.

Quercus tinctoria, Bartram.

Black or Yellow Oak. A large species, common to the lower Merrimack valley and eastward; absent on the highlands, and only again seen within three or four miles of the Connecticut river, ceasing at North Charlestown. The wood is elastic, strong, free-splitting, and durable, the bark very rich in tannin, and gives a yellow dye. This species is not valued as its merits deserve, for it would serve equally as well as white oak for many purposes.

Quercus rubra, L.

Red Oak. The most widely distributed and largest of our oaks. Very common in all parts of the state up to 1,500 feet above the sea, and only disappears in Coös county, far north of the White Mountains. The timber is not nearly so heavy as that of our other species, but, from the freedom with which it could be split and worked, the old growth has been mostly cut, and manufactured into staves for molasses hogsheads, an industry which flourished thirty or forty years ago, but has now disappeared from our state, owing to the scarcity of mature timber. Red Oak grows much more rapidly than the other kinds, and attains a diameter of four or five feet, with a height of seventy or eighty. The younger growth is now much used for the bent work in chair manufacture.

Fagus ferruginea, Ait.

Beech. This is essentially a highland tree, and does not become common until an altitude of five hundred feet above the sea is reached. It is a common tree on the Connecticut-Merrimack water-shed, and enters largely into the composition of the hard-wood forests of Coös county. In the south part of the state the best of it has been cut and used for chair-stock, bucket-hoops, etc. As it depends upon the seed alone for its propagation, it does not hold its own well in company with other trees, but is considered a valuable tree to grow. Wood dense and heavy; not very liable to warp, but easily perishable when exposed to the weather.

Castanea vulgaris, Lam, *var. Americana*, A. DC.

Chestnut. This well known and very valuable tree has a rather limited range in this state. The largest area where it flourishes is in the Merrimack valley south of Concord, although it occurs sparingly considerably north of that. In the Connecticut valley the most of it grows in the towns of Hinsdale, Winchester, and Chesterfield, but it grows near the river as far north as Windsor, Vt. The large timber has long ago been cut, but it is of such rapid growth that it yields large quantities of railroad ties in short periods of time. The wood is very durable when exposed to the weather, and has been much employed in fencing. It is much used as a cabinet wood, and for interior work of houses, building-timber, etc., and its planting should be encouraged wherever it will grow. It flourishes best in strong, well-drained soil.

Corylus Americana, Watt.

Common Wild Hazel. A slender shrub, forming dense thickets, mostly in the river valleys and southern exposures on the hillsides. Stems sometimes two inches in diameter, eight to fifteen feet high. Nuts edible; smaller than the English filbert, which they resemble; enclosed in a leathery, rounded involucre. The squirrels get the bulk of the fruit. Possibly it might be improved so as to rival its English cousin.

Corylus rostrata, Ait.

Beaked Hazel. A smaller species than the preceding. Commonest northward, in rich woods. Fruit enclosed in a long, beaked involucre, and in size and quality closely resembling the preceding species.

Ostrya Virginica, Willd.

Hop Hornbeam, Iron Wood, Lever Wood. A slender tree, with light-colored bark, brown-tipped branches, and birch-like leaves. Fruit inclosed in inflated sacs, which resemble those of the hop. Seldom more than forty feet high, with a diameter of a foot or eighteen inches. Wood white, very hard and stiff. Occurs in all parts of the state, but most abundantly along the high lands and northward.

Carpinus Americana, Michx.

American Hornbeam, Blue or River Beech. A large shrub or low tree, with wide-spreading branches, and blue-gray, fluted trunk. Wood hard, white, and heavy, but too small to be of much service. Grows throughout the state, near the larger streams.

Myrica Gale, L.

Sweet Gale. Shrub two or three feet high, growing along the borders of ponds, and in wet places. Found chiefly south of the White Mountains. Leaves aromatic.

Myrica cerifera, L.

Bay Berry, Wax Myrtle. A shrub from three to eight feet high, with deep green, shining, resinous-dotted, very fragrant leaves. Fruit a bony nut, encrusted with a white wax, which is sometimes collected under the name of "Bay Berry tallow." Common near the sea, somewhat frequent in the Merrimack valley, but only in one or two localities in the south-western part of the state.

Comptonia asplenifolia, Ait.

Sweet Fern. A low, bushy shrub, with sweet-scented, fernlike leaves. Grows best in dry, sterile situation, and is common throughout the eastern part of the state. Ranges with the white oak in the Connecticut valley.

Betula lenta, L.

Black Birch. A tree sometimes two to four feet in diameter, but usually not more than eighteen inches or two feet. Bark dark-colored, scaling from the trunk when old; heart wood reddish—this species therefore sometimes called Cherry or Mahogany Birch. The wood is heavier than that of the other birches, and takes the best polish, is much used in turning and cabinetwork, and makes a superior fuel. Its range is from the seacoast westward over the southern highlands, and in the Connecticut valley finds its northern limit not far from that of the chestnut.

Betula lutea, Michx.

Yellow Birch. The largest of our birches, often being three or four feet in diameter, and sixty or seventy feet high. The bark of the young trees is yellow, whence comes the common name. It grows in all parts of the state, but is most abundant in places which are more than five hundred feet above the sea level. The wood is nearly as valuable as that of the preceding species, which it much resembles in grain and density. It is much used in chair manufacture, and, like all species of birch, yields superior charcoal.

Betula papyrifera, Marshall.

White Birch, Canoe Birch. This species is found in all parts of the state, but may be called one of the types of the Canadian division of our flora, as it is the most common on the highlands, and only ceases to exist when the alpine area of the White Mountains is reached. It is conspicuous because of its very white bark, which was used by the Indians for making their canoes; and as it is easily separated into thin layers, it can be used for a variety of purposes, like the making of baskets, temporary pots for transplanting young plants, writing upon, etc. This tree is sometimes two or three feet in diameter, and sixty or seventy feet high; the wood moderately hard, yet capable of a good polish, and much used for spools, bobbins, chair-work, boxes, etc., and, when properly cured, makes a good fuel, but very easily decays upon exposure to the weather. Being of very rapid growth, it is of value for quickly reforesting lands, and preparing for a growth of oak, or other slow-growing trees.

Betula alba, L., *var. populifolia*, Spach.

Poplar-leaved, White, or Grey Birch. A slender tree of small diameter, and dingy white bark. Common to eastern New Hampshire, ranging as far north as Conway and around the base of Monadnock, and along the Connecticut to Westmoreland. Wood useful as fuel in the vicinity of the large villages, but back from such markets it is of more value as a material for making charcoal, for which it is excellent. The young shoots are much used for hoops, in the making of fish-barrels, nail-kegs, and other coarse cooperage. As it is very easily grown from the seed, and succeeds well in the most sterile soils, it could probably be used for a nurse in the starting of pine and other trees, which will not grow in such places without some protection when first sown.

Betula pumila, L.

Low Birch. Shrubby; two to eight feet high. Near Lake Winnipiseogee, and in the White Mountain region. Rare.

Betula glandulosa, Michx.

Dwarf Birch. A slender, half-trailing species, confined to the alpine region of the White Mountains.

Alnus viridis, DC.

Green or Mountain Alder. A stout shrub, with bright green colored branches. Forms dense thickets in the sub-alpine ravines of the White Mountains, and occurs sparingly throughout Coös county.

Alnus incana, Willd.

Common or Speckled Alder. A tall shrub, with stems one to four inches in diameter, and having few branches. Well known as forming thickets along all of the smaller streams, and in swampy places. Wood soft, of some use for fuel, and the charcoal made of it sometimes used in the manufacture of gunpowpowder.

Salix candida, Willd.

Hoary Willow. Shrub six or eight feet high, with narrow, lance-shaped leaves, downy above, and white woolly beneath. In bogs from Lancaster northward, and on the upper Androscoggin.

Salix tristis, Ait.

Dwarf Gray Willow. Low and slender; a foot or two in height, with downy or grey-woolly leaves and tips of the branches. Near the coast, around Nashua, and rarely in the south-western part of the state. Forms low masses in very dry, sterile soil.

Salix humilis, Marshall.

Prairie Willow. Usually three or four feet high, with wedge-oblong, downy or woolly leaves. Runs into many varieties, and is the common dwarf willow of dry hillsides and barren plains.

Salix discolor, Muhl.

Pussy Willow, Glaucous Willow. Tree-like, ten or fifteen feet high, large enough for fuel. Low grounds and moist hillsides. Flowers golden. Among the earliest of the willows.

Salix sexicea, Marshall.

Silky Willow. A slender species, forming upright clumps five or six feet high, in the vicinity of streams; leaves very narrow, smooth above, fine silky beneath. Flowers greenish.

Salix cordata, Muhl.

Heart-Leaved Willow. Stems five or six feet long; inclined, or half-trailing; leaves narrow, heart-shaped at the base. The commonest willow along the sand-bars and banks of the larger streams.

Salix livida, Wahl, *var. occidentalis.*

Livid Willow. Ten or fifteen feet high; usually with a short trunk and a much-branched head. Leaves very veiny, and livid when first expanding in spring. Common throughout the highlands. Prefers rather dry soil.

Salix chlorophylla, Anders.

Green Willow. Alpine ravines of the White Mountains; rare, and little known.

Salix lucida, Muhl.

Shining Willow. A very handsome species; rather common near streams. Usually ten or fifteen feet high, with broad, ovate, taper-pointed, shining leaves. Worthy of culture for ornament.

Salix nigra, Marsh.

Black Willow. The only one of our native species which rises to the dignity of a tree. This one is often forty feet high, and a foot in diameter. It confines itself very closely to the borders of the larger streams. The leaves are very long and narrow, taper-pointed.

Salix alba, L.

White Willow. This species, which often becomes a tree three or four feet in diameter, was introduced from Europe, and has become well naturalized throughout most parts of the state. The wood is light, strong, and durable, and useful for many purposes. This species is the one so extensively planted in the Western states for wind-breaks, fencing, and fuel. With us it is better than any other tree to plant along river banks where they are in danger of being undermined by freshets.

Salix longifolia, Muhl.

Long-leaved Willow. A common Western species, which finds its eastern limit along the Connecticut river, occurring from Westmoreland to the Massachusetts line. The slender shoots better than any other American species for basket-work.

Salix cutteri, Tuckerman,
Salix argyocarpa, Anders, and
Salix herbacea, L., are all dwarf alpine species, chiefly confined to the treeless area of Mt. Washington.

Populus tremuloides, Michx.

American Aspen. Called Quaking Asp in the Rocky Mountains. The most widely distributed of our poplars, being found in all parts of the state, up to 3,000 feet altitude, and in all varieties of soil except deep swamps. Usually a small tree ten to eighteen inches in diameter, and forty to sixty feet high. Springs up oftentimes in great abundance, where woodlands have been entirely cleared. The wood, when seasoned under cover, makes excellent fuel, but it easily decays when exposed to the weather. This species until recently was considered nearly worthless, but has now become of considerable value for the manufacture of pulp for paper.

Populus grandidenta, Michx.

Large-toothed Aspen, or Black Poplar. Ranges nearly with the last mentioned species, but most abundant within the altitudes of 500 and 2,000 feet above the sea. A tree much larger than the Quaking Asp, being sixty to eighty feet high, and two feet in diameter. Wood very white, of light weight, and strong—good for furniture, interior work, and for paper-making.

Populus balsamifera, L.

Balsam Poplar; both it and the variety *candicans* also called Balm of Gilead. A large species. With us it is native to the Connecticut valley, generally near the river, becoming more plentiful northward. The variety *candicans* is rarely found in a wild state, but is the form commonly planted, and botanically seems to be a transition between this and the next species. This poplar is a very rapid grower, and makes large timber. The wood is very soft, tough-grained, and easily decays. It spreads so rapidly by shoots from the roots as to become a pest where the land is at all valuable, but it could often be employed in waste lands, where a quick-growing tree is desirable for fuel.

Populus monilifera, Ait.

Necklace Poplar. This and the preceding species known through the West as "Cottonwood." It barely comes within our limits, being confined to the immediate vicinity of the Connecticut river, and disappears near the north part of Westmoreland. It is a large, handsome tree, and probably would be equal to the other poplars for paper-making.

Pinus Strobus, L.

White Pine. The largest, most useful, and having the greatest range of distribution of our conifers, being everywhere common, from the sea to 2,500 feet altitude. Originally two great belts occupied the valleys of the Merrimack and the Connecticut, which contained some of the finest timber in New England; but this magnificent forest has long since disappeared, but a few scattered remnants remaining. Specimens have been known which were more than two hundred feet high and six or eight feet in diameter. The white pine seeds very freely, and the site of the ancient forest is indicated by tracts of vigorous saplings which in twenty or thirty years are fit to cut for pail and fish-barrel staves, laths, clapboards, box-boards, etc., and in sixty years yields good timber and boards. Springing up as it does on so many worn-out and abandoned farms, it has made industry and wealth possible to many parts of the state which otherwise would have been wholly deserted. As it is our most useful evergreen, so it is the easiest to be made to grow, or it could not hold its own so well against the constant cutting to which it is subjected, and in any scheme of forest culture in our state it must hold the foremost place.

Pinus rigida, Miller.

Pitch Pine. This and the next species may be considered types of the Alleghenian division of our flora, because at their upper limit they approximate very closely to the contour line of six hundred feet. The pitch pine, when fully grown, is from fifty to seventy feet high and two feet in diameter, with heavy, very resinous wood, which is well suited for flooring and building timber; but the old growth, which accords with this description, has nearly disappeared, and the second growth is short and scrubby, better adapted for fuel than anything else; the wood also makes good charcoal. It is most common from the Merrimack valley to the sea, and to the base of the White Mountains. It delights in dry, sterile soil, and forms large tracts of wood land on the broad sandy plains of the Merrimack valley and lake region. It is to be met with, where the soil is favorable, in the southern highlands up to 1,000 feet above the sea, and along the Connecticut to the mouth of the Passumpsic.

Pinus resinosa, Ait.

Red Pine, also very commonly called Norway Pine, a name which is erroneous, as this tree is not a native of Europe. The botanical name also is a bad one, as the wood is not specially resinous. It is a very handsome species, growing from sixty to eighty feet high, holding well its diameter, and makes excellent building timber and floor-boards. It ranges with the pitch pine, but is less common, being usually in groves of from a few acres to several hundreds in extent. It will grow well in the sterile soil preferred by the pitch pine, and as it is so much more valuable as a timber tree, it is preferable for planting in such places. During the first twenty years of growth it attains a larger diameter than either the white or pitch pine.

Picea nigra, Link.

Black Spruce. Belongs to the Canadian division of our flora; the most abundant conifer of upper Coös, the White Mountain region, and the higher parts of the Connecticut-Merrimack water-shed; next to the white pine, the most important evergreen, and with the balsam fir, the last to give way to the alpine White Mountain area. It then becomes dwarfed, with a short trunk, two or three feet high, with dense branches, spreading twenty-five or thirty feet, making a mat strong enough to walk upon. Its timber composes the greater part of the drives of logs which are annually floated down the Connecticut, Merrimack, and Androscoggin. The wood is light, elastic, and strong; valuable for a great variety of uses, both for inside and outside work, paper pulp, etc. In the White Mountain region and northward it grows very rapidly, but on the southern highlands, where the old growth has been mostly removed, the younger does not seem to start quickly, and the timber is coarse and knotty.

Picea alba, Link.

White Spruce. A Canadian species, abundant around the sources of the Connecticut, disappearing at the Fifteen-mile falls on that river. It is a medium-sized tree, the wood similar to that of the black spruce, but the tree more symmetrical in outline, with light-colored bark, and a bluish-green appearance to the leaves.

Abies balsamea, Marshall.

Balsam Fir. Ranges with the black spruce, and equally common with it in the White Mountains and upper Coös county. In the southern part of the state, around the sources of the Contoocook and Miller's rivers, are extensive swamps where this is the prevailing timber. It is the most symmetrical of the spruces; sometimes attains two feet in diameter; is short-lived, and, until recently, considered worthless, but is now considered to be good for boards and shingles, which bear exposure to the weather as well as the hemlock. The trunk is covered with large blisters, which yield the Canada balsam employed in medicine and microscopy.

Abies Fraseri, Lindl.

Fraser's Balsam. A species common on the southern Alleghanies; is rarely found in the sub-alpine region of the White Mountains.

Tsuga Canadensis, Carriere.

Hemlock. The most widely distributed of our spruces, ranging from the sea to 2,000 feet altitude in the White Mountains, and disappearing before reaching upper Coös county, but appears again in the valley of the St. Lawrence. A large tree, and when young the most graceful of our conifers ; well adapted for ornamental planting. Its bark is so much sought after for tanning leather, and the wood for boards, shingles, and building timber, that the old growth is mostly gone. It does not seed as freely as the pines, but with a little care and protection can be very easily grown, and a tract of hemlock forest would probably yield a revenue next to that of one of white pine.

Larix Americana, Michx.

American Larch, Hackmatack, Tamarack. The only deciduous-leaved conifer found in north-eastern United States. A tall, slender tree, preferring cold, highland swamps, but occasionally met with in eastern New Hampshire. In Cheshire county, south of Monadnock, on the water-shed of the Contoocook and Miller's rivers, are great swamps where the tree is very abundant. Then in Dalton, Lisbon, Whitefield, and Bath in the Connecticut valley, and Milan, Millsfield, and Dummer on the Androscoggin, it appears in great quantity. The roots strike out at right angles from the trunk, generally three or four very large ones. The tree is dug up, and four or six feet of the trunk taken off with the roots, to be sawn up into the "knees" used in ship-building. The timber is hard, very heavy, and moderately durable when exposed to the weather. Probably inferior to the European larch, but would be a good tree to grow upon lands that cannot be easily drained.

Thuya occidentalis, L.

Arbor Vitæ, or White Cedar. This may be considered the typical conifer of the Canadian division of our flora, being mostly confined to the upper part of Coös county, disappearing in the Connecticut valley at the White River Narrows near Hanover, and only seen in a few isolated localities south of the White Mountains. This tree has light, soft, very durable wood, excellent for shingles, fencing, telegraph poles, etc. It sometimes attains a diameter of three feet, but not usually more than eighteen or twenty inches, and fifty or sixty feet high. It is much used to plant for evergreen hedges, and in this form is common in all towns and villages.

Chamæcyparis sphæroidea, Spach.

White Cedar, Cypress. Until recently classed botanically as a true cypress. With us it is limited to Rockingham county near the coast, in deep swamps and marshes. A middle-sized tree, with wood similar to that of the arbor vitæ. Useful for boat boards, shingles, telegraph poles, and fencing.

Juniperus Virginiana, L.

Red Cedar. A small tree, growing in dry, sterile soil. It is most frequent in the south-east part of the state. Appears in the Connecticut valley sparingly as far as Haverhill, and found also in Hart's Location. Wood very durable, and valuable for fuel and fencing, and the handsome, deep-red heart-wood for ornamental purposes. It has the slowest growth of any of our conifers.

Juniperus communis, L.

Savin. A prostrate, wide-spreading shrub, which sometimes overruns worn-out lands. Has the same range as the red cedar.

Taxus baccata, var. *Canadensis*, L.

Canadian Yew, or Ground Hemlock. Much like the savin in habit, has brownish-green leaves, and the fruit becoming fleshy resembling a red berry. Grows in cold, deep woods throughout the state.

TABLE 6.

SHOWING THE DISTRIBUTION OF THE ARBORESCENT VEGETATION OF NEW HAMPSHIRE.

I. *Alleghenian Division.*	II. *Canadian Division.*	III. *Those species common to both Divisions.*
Berberis vulgaris.	Acer saccharinum.	Tilia Americana.
Zanthoxylum Americanum.	A. spicatum.	Rhus typhina.
Rhus glabra.	Rubus odoratus.	R. Toxicodendron.
R. copallina.	Rhamnus alnifolius.	Acer rubrun.
R. venenata.	Staphylea trifoliata.	A. Pennsylvanicum.
Robinia Pseudacacia.	Ribes Cynosbati.	Prunus Americanum.
Acer dasycarpum.		
Prunus Virginiana.	R. lacustre.	P. Pennsylvanicum.
P. pumila.	R. prostratum.	P. serotina.
P. maritima.	R. rubrum.	Rubus strigosus.
Spirea salicifolia.	Cornus stolonifera.	Cratægus Crus-galli.
S. tomentosa.	Pyrus Americana.	Ampelopsis quinquefolia.
Rubus occidentalis.	Lonicera cilliata.	Cornus circinata.
R. villosus.	L. cœrulea.	Cornus sericea.
R. Canadensis.	Sambucus pubens.	C. alternifolia.
Rosa Carolina.	Viburnum Opulus.	Pyrus arbutifolia.
R. blanda.	Vaccinium oxycoccus.	Amelanchier Canadensis.
R. lucida.	V. Vitis Idæa.	Diervilla trifida.
R. rubiginosa.	V. ugilinosum.	Sambucus Canadensis.
Cratægus cocinea.	V. cæspitosum.	Viburnum nudum.
Vitis Labrusca.	V. Canadense.	V. acerifolium.
Vitis æstivalis.		V. lantanoides.
Vitis riparia.	Cassiope hypnoides.	Vaccinium macrocarpon.
Rhamnus catharticus.	Andromeda polifolia.	Nemopanthes Canadensis.
Ceanothus Americana.	Phyllodoce taxifolia.	Fraxinus Americana.
Celastrus scandens.	Kalmia glauca.	F. sambucifolia.
Ribes hirtellum.	Rhododendron Lapponic'n.	Ulmus Americana.
Cornus florida.	Ledum latifolium.	Juglans cinerea.
C. paniculata.	Loiseleuria procumbens.	Quercus rubra.
Nyssa Sylvatica.	Dirca palustris.	Corylus Americana.
Lonicera parviflora.	Fagus ferruginea.	Betula lutea.
Viburnum Lentago.	Corylus rostrata.	Alnus incana.

TABLE 6—*continued.*

I. *Alleghenian Division.*	II. *Canadian Division.*	III. *Those which are common to both Divisions.*
V. dentatum.	Ostrya Virginica.	Salix discolor.
Cephalanthus occidentalis.	Betuba papyrifera.	S. sericea.
Gaylussacia resinosa.	B. pumila.	S. cordata.
Vaccinium Pennsylvanic'm.	B. glandulosa.	S. livida, var. occidentalis.
V. vacillans.	Alnus viridis.	S. lucida,
V. corymbosum.	Salix candida.	S. alba.
Arctostayphlos uva-ursi.	S. Cutleri.	Populus tremuloides.
Cassandra calyculata.	S. argyocarpa.	P. grandidenta.
Andromeda ligustrina.	S. herbacea.	
Clethra alnifolia.	Populus balsamifera.	
Kalmia latifolia.		
Kalmia angustifolia.	Picca nigra.	Pinus Strobus.
Rhododendron viscosum.	P. alba.	Tsuga Canadensis.
R. maximum.	Abies balsamea.	Larix Americana.
R. nudiflorum.	A. Fraseri.	Taxus Canadensis.
R. Rhodora.		
Ilex verticillata,	Thuja occidentalis.	
I. lævigata.		
Fraxinus pubescens.		
Ulmus fulva.		
U. racemosa.		
Celtis occidentalis.		
Platanus occidentalis.		
Carya alba.		
C. porcina.		
C. tomentosa.		
C. amara.		
Sassafras officinale.		
Lindera Benzoin.		
Quercus alba.		
Q. bicolor.		
Q. oblusiloba.		
Quercus Prinus.		
Q. Prinus, var. humilis.		

TABLE 6—*concluded.*

I. *Alleghenian Division.*	II. *Canadian Division.*	III. *Those which are common to both Divisions.*
Q. ilicifolia.		
Q. tinctoria.		
Castanea vulgaris, var. Americana.		
Carpinus Americana.		
Myrica gale.		
M. cerifera.		
Comptonia asplenifolia.		
Betula lenta.		
B. populifolia.		
Salix tristis.		
S. humilis.		
S. nigra.		
S. longifolia.		
Populus monilifera.		
Pinus rigida.		
P. resinosa.		
Chamæcyparis sphæroidea.		
Juniperus Virginiana.		
J. communis.		

TABLE 7, SHOWING THE RELATIVE SPECIFIC GRAVITY AND APPROXIMATE FUEL VALUE OF THE PRINCIPAL NEW HAMPSHIRE WOODS: COMPILED FROM PROF. C. S. SARGENT'S REPORT ON THE FOREST TREES OF NORTH AMERICA FOR THE TENTH CENSUS.*

No.		Specific Gravity.	Fuel Value.
1	Carya alba	.8372	83.11
2	Carya tomentosa	.8219	81.29
3	Carya porcina	.8217	81.36
4	Cornus florida	.8153	80.98
5	Ostrya Virginica	.8284	82.42
6	Amelanchier Canadensis	.7838	77.95
7	Quercus bicolor	.7662	76.18
8	Betula lenta	.7617	75.97
9	Carya amara	.7552	74.74
10	Quercus Prinus	.7499	74.42
11	Quercus alba	.7470	74.39
12	Robinia Pseudacacia	.7333	72.96
13	Celtis occidentalis	.7287	72.08
14	Prunus Americana	.7215	72.02
15	Cratægus Crus-galli	.7194	71.54
16	Kalmia latifolia	.7160	71.31
18	Ulmus fulva	.6956	69.77
19	Acer saccharinum, var. nigrum	.6915	68.66
20	Acer saccharinum	.6912	68.75
21	Betula lutea	.6553	65.34
22	Fraxinus Americana	.6543	65.16
23	Quercus rubra	.6540	65.28
24	Ulmus Americana	.6506	64.54
25	Fraxinus sambucifolia	.6318	62.72
26	Rhododendron maximum	.6303	62.80
27	Fraxinus pubescens	.6251	62.35
28	Larix Americana	.6236	62.16
29	Acer rubrum	.6178	61.65
30	Betula papyrifera	.5955	59.40
31	Prunus serotina	.5822	58.14

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* The specimens used for specific gravity were dried at 100° Centigrade until they ceased to lose weight. The specific gravity was then obtained by measurement with micrometer calipers and calculation of the weight of the blocks.

The relative fuel values are obtained by deducting the percentage of ash from the specific gravity, and are based on the hypothesis that the real value of the combustible material in all woods is the same.

TABLE 7—*concluded.*

No.		Specific Gravity.	Fuel Value.
32	Betula alba, var. populifolia...	.5760	57.43
33	Pyrus Americana....................	.5451	....
34	Acer spicatum........................	.5330	....
35	Acer Pennsylvanicum.................	.5299	....
36	Acer dasycarpum....................	.5269	52.52
37	Pinus rigida..........................	.5151	51.39
38	Sassafras officinale...................	.5042	50.38
39	Prunus Pennsylvanica................	.5023	....
40	Juniperus Virginiana..................	.4926	49.11
41	Populus grandidentata	.4632	46.11
42	Picea nigra...........................	.4584	45.71
43	Tilea Americana......................	.4525	45.00
42	Castanea vulgaris, var. Americana......	.4504	44.95
43	Salix nigra	.4456	....
44	Rhus venenata........................	.4382	....
45	R. typhina............................	.4357	....
46	Salix discolor........................	.4261	....
47	Tsuga Canadensis....................	.4239	42.20
48	Populus balsamifera, var. candicans.....	.4161	41.42
49	Picea alba.............	.4051	40.38
50	Populus tremuloides..................	.4032	40.10
51	P. monilifera.........................	.3889	38.53
52	Pinus strobus........................	.3854	38.47
53	Albies balsamea......................	.3819	38.02
54	Populus balsamifera..................	.3635	36.11
55	Chamæcyparis sphæroidea.............	.3322	33.12
56	Thuya occidentalis....................	.3164	31.53

FOREST MANAGEMENT AND REFORESTING.

Not only is it desirable that the area at present occupied by forest in New Hampshire shall be preserved, and the resulting products taken from them with as little injury to the land and young wood as possible, but there are many large, cleared tracts which should be returned to woodland as soon as they can be, both from the economic and climatic point of view. These lands are mostly either the sandy or gravelly plains, which form the highest terraces of the rivers, high hill and mountain pastures, or farms which have been abandoned because of impoverished and cold, sterile soil. To look at many of these farms at the present day, would be to wonder at the crude ideas and short-sighted policy of the first settlers, which caused them to clear land so obviously designed for sylviculture instead of agriculture.

The mischief is done, however; the thin soil gathered from the *débris* of centuries of forest vegetation is now gone—either burned up, washed away by the rains, or exhausted by cropping and pasturage. Nature is endeavoring to again cover these lands with a growth of trees; and one of the hopeful aspects of the forestry problem is the rapidity with which these worn-out lands, in many instances, are being covered with thrifty saplings. There are, however, many exposed hill and mountain tops and sandy areas where it will take very long periods for unassisted nature to reforest them, and its action is liable, in many instances, to be nullified by the methods pursued by the owners of the lands. It is here that the problem becomes difficult. There is as yet no system of caring for the forests of America, as has been in vogue for centuries in European countries, and the process of educating the land-owner to recognize the importance of such a system of forest culture will be a slow one.

People generally have the idea that the forests of the state are naturally renewed as fast as they are cut, and therefore no especial pains in that regard need be taken: hence, the notion prevails that the best way to procure pasturage to replace that which has been worn out is to cut the young wood clean, and burn the land over, sowing grain and grass-seed afterwards, selling, of course, all the available forest products, and they do not seem to remember that the leaf-mold accumulated during a few decades is usually destroyed by the process, so that the land becomes in a few years more barren than ever. This senseless method is very frequently pursued, not only with second growth woodlands, but extended to rocky hills and ravines, which the early settlers considered worthless for clearing. The primeval tract included by the White Mountain region has recently been invaded by the axe, and we have every reason to suppose that fire will quickly follow and complete the process of desert-making on the watersheds of our principal rivers.

The people of New York state, having become alarmed because of the decrease of the flow of the Hudson and other streams which drain the Adirondack region, have been considering how a way may be devised to prevent any further forest destruction within its limits. The White Mountains are just as important to the welfare of New Hampshire, and the state should devise some plan by which these forests can be perpetually preserved. The owners of lands in other parts of the state should be encouraged to return such as are not easily cultivated, or well fitted for such use, to forest as soon as they can be. This might be brought about, to some extent, by exempting from taxation woodland having trees of a certain diameter, also artificially planted tracts, whenever there may be any such, with the addition of a small bounty to encourage the making of such plantation.

Excessive taxation is generally given as a reason for cutting woodlands, which is a difficulty which could be obviated by legislative action. Some claim that the right of *eminent domain* should be asserted, and the cutting of the forest regulated by the state, as is done in Europe. It would, perhaps, require a change in our constitution before such a step could be taken, yet the decreasing water-supply may some time bring the people to the consideration of such a measure. The present state of affairs has been brought about by careless and wasteful methods of forest working, and it will take a great deal of time to restore the old order of things as regards climate and water-supply; and, so far as the quality of the timber is concerned, it is only the most careful and intelligent working of the forests through generations, which can bring them to equal those which have been destroyed.

Wood as fuel, though very important, will never be a primary consideration. The coal fields of the United States are so extensive, and the means of transportation over the country so rapid and cheap, that hereafter wood will be of local importance as fuel. But nothing can take the place of timber in the arts; and the production of timber, therefore, as adapted to building construction and the various manufactures in which the use of wood is indispensable, should be the aim of the owner of forest lands. If these lands are judiciously managed, the wood derived from the thinning, and the tops of the trees taken for timber, will be sufficient for the homestead and local market. Prof. C. S. Sargent, in his report of the forest trees of New Hampshire for the tenth census, says,—"The wide areas now covered in New England by a vigorous growth of white pine, although insignificant in extent and productiveness in comparison with the forests it replaces, must not be overlooked in considering the pine supply of the country. These new forests, yielding already between two and three hundred million feet of lumber annually, are capable of great future development."

In this country the attempts at forest culture, and the planting of waste lands, have been so few that there are no examples for the people generally to imitate. Our ragged forests are said to present the most marked contrast possible to those of Europe, where many years of careful working have produced woods containing trees of uniform height, evenly distributed over the ground. The trees there are usually planted, or the seed sown thickly and then thinned at stated periods, so as to produce a tall trunk with few branches. The product of the various thinnings pays a handsome profit above the expense of the care and work. With us, the winds, birds, and squirrels are the chief tree-planters. In some cases they do their work effectually, but on the highest and most exposed lands sparse seeding results in a scrubby, heavy-branched growth, fit for little except fuel.

The common custom of allowing cattle to run in young woodlands is almost as injurious as to allow them to be overrun by fire. They destroy the greater part of the seedlings, and browse the young trees so as to greatly injure them for making good timber.

It is the European practice, in order to quickly reseed a forest, so that it will take the place of one cut off on the same ground, to first remove a portion of the trees—say one half or three fourths. The remainder, being thus opened out to light and air, will, in the course of two or three years, seed very freely; and the underbrush and dead branches having been removed, the young seedlings spring up thickly and evenly over the whole ground. The large trees are then carefully removed, and the young forest comes forward very rapidly.

This method could be adopted with great advantage in the working of New Hampshire forests, for it would give an even young growth, without vacancies, in far less time than the usual method of cutting clean and leaving the brush upon the ground to smother the seedlings, and liable to fire.

Hill-tops, steep valley sides, and thin, ledgy places, should never be cleared entirely. The better way would be to remove the largest trees only, leaving the smaller ones to come forward and take their places, never exposing the soil to the washing of the rains and the drying influences of the sun and winds.

REFORESTING WASTE LAND.

There are only a few ways of reforesting the waste lands of the state. First, by allowing Nature to do the work of sowing the seeds of indigenous species in her own way; second, by planting or sowing the seeds of the most valuable species and varieties, where they are to grow and mature; third, by transplanting small trees from the forest, directly to tracts to be restocked; fourth, by growing seedlings under glass, or in prepared beds out of doors, and transplanting when of suitable age and size; or, fifth, by purchasing seedlings grown in the manner last named, and restocking all waste places at once.

Much may be accomplished in any one of the ways named. It may be well to consider for a moment some of the advantages and difficulties attending each method.

Where seeds are sown by the wind, and by birds, squirrels, and other small animals, we are not sure of an even distribution. The light seeds are blown into thick undergrowth, or under fences, where they form hedge-rows, while most of the land remains open and unoccupied for years. This method, therefore, is slow and unsatisfactory.

Some have been successful in planting trees where they are to grow, and claim that this practice is the most simple, certain, and inexpensive. There is no doubt but the oaks, hickories, walnuts, and chestnuts may be successfully planted by simply opening furrows with a plow, dropping the seed, and covering, as the farmer covers his potatoes. When the land is so rough as to preclude the use of a plow, a grubbing-hoe may be substituted. Planted in this way, the maples, ashes, and other small-seeded species will in many instances fail, and, as a rule, the conifers will fail entirely.

There is great danger that nuts and acorns will be appropriated by squirrels, and that mice, birds, and insects may destroy the smaller seeds. It would be well to make a liberal allowance for contingencies where this practice is adopted.

The third method—transplanting trees from the forest—is practicable, and may sometimes be advisable, but it is more expensive, and attended with some difficulties. Small trees of the most desirable varieties are not often to be found in sufficient numbers for the purpose, and if found, could only be procured by purchase. It should be borne in mind that there is much more risk and labor in transplanting from the forest, than from the seed-bed or nursery row.

As to starting seeds in boxes under glass, though possibly the best method, few have the facilities for so doing, and it is not likely to be extensively practised. It has several advantages,—namely, the temperature and humidity of a glass structure are under complete control at all times, the seeds are exempt from the depredations of animals and insects, and, as they are sown in autumn, can be kept growing all winter, so that the trees will be ready to plant out in spring before those sown out doors have germinated. These seedlings escape the sudden and extreme changes peculiar to our climate, so destructive to young plants, especially of the conifers. In this way not a root is destroyed in transplanting, but every fibre is preserved intact. At the end of five years trees thus grown will have attained a much larger size than by any other method. But most seedlings will be grown in the open air, and we may well consider how this can best be done.

With the nuts and acorns, there need be no failures if the seeds have been properly wintered, kept from becoming dry and exposed to frost. They may be planted in drills, with as little danger of failure as sets of a potato. Select land free from rocks, to avoid hard work in digging. Make the soil mellow and fertile, to ensure a strong and upright growth. Avoid land that is liable to be washed or flooded with water, in case of heavy rains. Plant in rows wide enough for a cultivator to pass, and place the seeds three or four inches apart in the drills, and two inches deep. Give clean cultivation.

Some take up the seedlings in the fall, and "heel them in," to prevent their being thrown out by frost, but this is not necessary if the land is a well-drained, sandy loam. Take up the trees in spring, grade them as to size, cut back their tap-roots, and reset, giving greater distance in the rows. If any are ill-formed, cut back to a bud near the ground, and this will send up a straight shoot.

There is little danger of transplanting too often, but it is not best to do so every year. The effect is the production of numerous fibrous roots, and thus renders the work of final planting out perfectly safe. It is almost impossible to transplant the nut-bearing and evergreen trees directly from the forest with success, owing to their lack of fibrous roots. It can only be done when the trees are small, so that the whole system of roots can be removed, with sod or soil attached. After being two or three times transplanted in the nursery, they may be as safely moved as a willow.

SELECTION OF SOIL.

Many species usually found only in low swamps can be successfully propagated and grown in high and dry situations. Our native spruces *(Picea nigra*, *Picea alba*, and *Abies balsamea)*, larch *(Larix Americana)*, and cedars, will flourish equally well and make a more rapid growth on elevated land, even though it may be light, and wanting in fertility.

While I would not select, as best for the purpose, a thin, starving soil, I should not hesitate to plant trees, especially evergreens, upon almost any of our sandy plains. The white pine *(Pinus strobus)* and hemlock spruce *(Tsuga Canadensis)* would doubtless attain greater size eventually on stronger soil; yet it is matter of common observation, that they make a rapid growth, and seem perfectly at home on gravelly plains and ridges, so poor as to be worthless for any other purpose. For evergreens, a mellow surface, with a somewhat porous sub-soil of sand or gravel, will ensure a vigorous, healthy growth. Such tracts have the additional advantage of being more easily stocked with seedlings than any other. The thick seeding that often occurs on the windward side of a pine growth, without the aid of cultivation, must have attracted the notice of the most casual observer. This should serve as a hint to every owner of such waste land, as it shows how easily it may be covered with a valuable forest. It is only necessary to sow the seed broadcast, and cover lightly with a smoothing-harrow, to ensure germination. These natural nurseries often contain, on a small area, seedlings enough, if transplanted at proper distances, to cover tracts of several acres.

NATURAL SEEDING.

The spruces and larches, native and foreign, scatter their seeds without our aid, and these spring up in pastures and wild lands generally. A few trees of the Norway spruce *(Picea excelsa)*, of the black spruce *(P. nigra)*, and European larch, set in the grounds of the writer, when small, thirty years ago, have attained a diameter of eighteen inches, and are seeding a neighbor's pasture and wood-lot in all directions. If not dug up for ornamental planting, they would soon cover the ground with a beautiful forest. These seeds mature annually, and are carried by the wind, so that the young trees may be found at a distance of a hundred rods. The seeds of the pines, arbor-vitæ *(Thuja accidentalis)*, elm *(Ulmus Americana)*, maples, ashes, and birches, are sown in the same way, only a small percentage of which ever germinate.

Other trees produce seeds too heavy to be widely scattered in this way, and are dependent on the agency of birds and small animals for their dissemination. Among these are the oaks, hickory, walnut, cherry, and beech.

The hedge-rows by the sides of fences are the result of seeds dropped by birds, and secreted by squirrels for winter food. It is not uncommon to see the ground under hickories in the forest thickly set with young trees, the nuts having fallen and been covered by leaves. They have been placed in just the condition best suited to their preservation, germination, and growth. The mulch of leaves has prevented drying, the shells have been opened by frost, and the young plants have been screened from the hot sun and drying winds—all conditions most essential to success in growing seedlings of nut-bearing trees.

Old lumbermen tell us that the white pine *(Pinus strobus)* is the most rapid and profitable growth among all our forest trees, and it is certain that it is the one most easily propagated.

The pitch pine *(Pinus rigida)* and red pine *(Pinus resinosa)* will flourish on even poorer soil, if possible, than the white pine. The pitch pine plains are among the poorest soils of our state, yet they seem well suited to the growth of the different species of pine. They will grow in the most barren drift, and on the moraines and knolls composed of coarse gravel and rocks, from which nearly every vestige of clay, loam, and vegetable matter has been washed in past ages.

There are thousands of acres of pitch pines now growing in the pure sea sand of Cape Cod, the seed having been sown in furrows six or eight feet apart. A large amount of fuel is obtained by thinning, as the trees increase in size and become too thick to admit of full development. The planter is thus early getting a return for the trifling expense of seed and sowing, with a prospect of reaping a more valuable harvest of lumber in the future.

PREPARING A SEED-BED.

The seeds of the conifers are small, and should be sown in drills a foot apart, and be covered from one fourth to one half an inch deep, and the soil over them should be made quite firm. A plot where no water will stand on or near the surface, and still not liable to be washed by heavy rains, must be selected. A sandy loam, with a mixture of well decomposed muck, leaf mold, or peat, with a little old manure added, and the whole worked firm, will be favorable for the germination of seeds and the growth of the plants.

The common cold frame used by market gardeners—six feet wide, and as long as may be desired—will be found convenient, and all that is needed to give protection in winter or summer. When the seeds are sown in autumn, sash or shutters are to be placed over the frames and tilted when the weather is warm, so as to give air, and avoid too great an accumulation of heat.

As spring approaches, the seeds will germinate, and the young seedlings begin to push above the ground. They will require watching daily, to prevent their becoming dry, or burning by too high a temperature. Light watering must be given from time to time, so as to preserve a humid air inside of the frame. Shading the beds by lath screens, as elsewhere suggested, is always safe until the plants have become well established.

Mr. Meehan, editor of the *Gardener's Monthly*, recommends the following method: "A common board frame is placed over a carefully prepared bed of light mold, and covered with shaded hot-bed sash. Under each corner of the frame is placed a prop, raising the bottom about three inches above the surface of the ground. The advantages of this contrivance will be appreciated, when we consider that the most essential conditions, in raising evergreen seedlings, are to obtain a moist atmosphere, protection from the direct rays of the sun, and at the same time a free circulation of air through the plants."

SOWING SEEDS OF EVERGREENS.

Seeds of the red cedar *(Juniperus Virginiana)*, and a few others, should be mixed with sand, and allowed to freeze during winter; but the pines, spruces, etc., may be sown early in spring, in cold frames, secure from heavy frosts. If not sown before

April, it is hard to get them through the summer. The first three months is the critical time with such seedlings. These seeds are sometimes sown late in autumn, but many of the most successful propagators prefer the early spring.

Too thick seeding is to be avoided, as the tender plants are more likely to damp off or draw up, when shorter and more stocky seedlings are desirable. The native evergreens are not tender, and the young plants are more likely to be injured by heat and drouth, than by cold. For this reason the bed or frame containing seedlings should be located on the shady side of some fence, building, or hedge, secure from the direct rays of the sun, and from drying winds. Partial shade may be secured by a screen made of laths, nailed one inch and a half apart, or by evergreen boughs, during the hottest part of the summer, to be removed as the cooler weather approaches, and the plants acquire age and size. At no time should the tender seedlings become dry, as drouth, followed by copious watering, is fatal.

To prevent the seed-bed from becoming dry, mulching with sphagnum, chaff, sawdust, or pine leaves, will preserve a more uniform degree of humidity than can be secured by the frequent application of water. If, however, watering becomes necessary, which will not often occur when mulching is practised, it must not be neglected. The directions here given are intended as a guide only to those wishing to grow the hardy evergreens, and do not apply to tropical species, which would require different treatment.

Seeds should be sown in rows running across the beds, one foot apart, with paths between the beds at least two feet wide.

HOW TO OBTAIN SEEDS.

There will be no trouble in obtaining seeds of the oaks, walnut, hickory, beech, and chestnut, but of some other species they are not equally accessible. The elm and maples sometimes ripen their seeds in such profusion as to cover the ground. How best to secure them is a conundrum that we leave others to solve. There is the same difficulty in obtaining seeds of evergreens, as they shed their seeds in the fall, as soon as the frost lifts the scales of their cones. If the cones could be gathered before being opened by frost, they would give us an abundant supply of seeds; but unfortunately they are beyond our reach. Seeds of the pines can sometimes be obtained when timber is being cut in the nick of time.

We have often seen the ground so covered with the pill-like seeds of the European linden, that, if sugar-coated, the dealer in patent medicine might make them available in his business. Fortunately there are persons who know how to secure all the different seeds required, and there are dealers who make a specialty of supplying them in large or small quantities. Forest-tree seeds can be ordered of almost any seedsman, who will furnish them, if not in stock, with very little delay, and at reasonble prices. There is always more or less uncertainty about their quality, as there is no general demand for them, and they are liable to become so venerable with age as to lose their vitality*.

The best time for gathering all seeds of forest trees is as soon as they are ripe, and unless they are planted at once they must be carefully preserved. There is no better way in which to keep the seeds of conifers than in the package nature has provided for them. Some of the small seeds may be kept in the ordinary seed-bags of cloth or paper, and, if stored in a cool, dry place, they will retain their vitality for several months, possibly for years.

But dried seeds start slowly; many never grow, and others remain in the ground one, two, and even three years before germination. For this reason it is better to mix seeds with damp—not wet—sand as soon as gathered, especially if the sowing is to be deferred till spring. They may be put in boxes having holes in the bottom to ensure drainage, and the whole buried in the ground during winter. The seeds may be separated from the sand in spring by screening, or they may be sown together in shallow drills, as elsewhere directed.

The large seeds, such as the hickory and the oak, must never become dry, neither should they be kept wet and warm. They require exposure to frost, which opens their shells and allows the germ and radicle to escape at the proper season.

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*Mr. Thomas Meehan, of Philadelphia, has a full line of tree seeds, catalogues of which may easily be obtained. He is regarded as a very intelligent and reliable man.

Spreading nuts and pits upon the ground as soon as gathered, and covering lightly with sand or with boards to prevent the depredations of squirrels, will carry them through the winter in a perfect condition. The shells, having been kept moist and acted upon by frost, will be found so loose as to be easily removed with the fingers; but if any are still inclined to adhere, a slight tap with a hammer will be required.

The seeds of the chestnut, beech, and some others, are covered by a thin and not very hard shell; and if the nuts are planted where they are to grow, or in nursery rows, before becoming dry, will germinate with no further trouble.

SOME CAUSES OF FAILURES.

One cause of failure with all seeds arises from too deep planting. As a rule, they should not be covered to a depth greater than twice their diameter. If the soil is loose, the planting may be deeper than when more compact. It is never safe to plant seeds in wet or very heavy soil. All seed beds must be well drained.

It will be seen that when the seeds are small the covering must be very shallow; if too deep, they germinate and decay. Make the covering over the seeds firm, and mulch lightly to prevent evaporation and drying. If a seed swells and again becomes dry, it receives a shock from which it is not likely to recover. Remove the mulch from directly over the plants as soon as they appear above the surface.

The seeds of conifers germinate readily, but the plants are exceedingly liable to be lost by unfavorable conditions before the formation of their true seed leaves. It is at this point that experiments in growing evergreen seedlings are most likely to fail. When the plant has so far advanced that the true leaves have become well developed, and the radicle is able to furnish the required nourishment, less care will be required.

As elsewhere stated, there are a few species of deciduous trees that mature their seeds in spring or early summer. The seeds of all such may, and should, be sown at once. They will germinate in a short time; and if properly shaded, watered, and otherwise attended to, will make a good growth by fall. When such seeds are simply sown by the wind, probably not one in a thousand ever germinates, and of these only occasionally one survives, owing to our hot sun and drying winds.

Many seeds will fail from lack of vitality. They may germinate, but never grow. The vitality of seeds will continue for only so long a time as the various substances of which they are composed remain unchanged. Many seeds contain a large percentage of oil, that, under certain conditions, soon becomes rancid, and destroys their vitality. The same effect is produced by undue moisture and heat. When a seed absorbs moisture, oxygen is also absorbed, the starch and other substances are decomposed, and if heat is present, germination commences. Small seeds that are to be transported long distances, by mail or otherwise, should be dry, and so packed as to exclude moisture. Before planting, soak the seeds in tepid water for two days, or until they have become swollen. If seeds of the maple are kept dry through the winter, but few of them will germinate before the second year.

Mr. Jackson Dawson, of the *Arnold Arboretum*, says,—" In sowing in the fall, begin with the oak, chestnut, hickory, and beech nuts, which do not retain their vitality long, and must be either planted, or put in boxes of earth as soon as practicable. The maples, with the exception of the white and red, which ripen their seed in June, should be sown as soon as possible after gathering. The ash must also be sown at once. The hornbeam and hop-hornbeam will not come up until the second year, unless sown in the autumn. The tupelo, flowering dogwood, shad-bush, nettle tree, viburnums, and thorns, seldom come up till the second year. The plum, peach, apple, and pear never come up evenly the first year unless the seed has been frozen or kept in boxes of moist earth. The tulip-tree invariably takes two years. The ailantus, catalpa, mulberries, button-ball, birches, and alders, are best sown in spring. The white and scarlet maples, the elms, and the red or river birches, ripen their seed early in summer, and should be sown in freshly prepared beds as soon as gathered."

PURCHASING SEEDLINGS.

There may be some who will distrust their ability to grow the more delicate seedlings successfully. For the benefit of such, it may be stated that small trees may be purchased at a very low price. There are parties at the West who, having the requisite facilities and skill, make the growing of evergreen and forest-tree seedlings a specialty. They supply them at what would seem to be merely a nominal price, and there are dealers much nearer who would furnish them cheaper than they can be grown by a novice. In a catalogue before me, trees from six to twelve inches high are invoiced at $3 per thousand.

It will require but 544 trees to cover an acre when set eight by ten feet apart, at an expense, with purchased seedlings, of $1.63. To this should be added packing and freight; but even then it may be thought advisable to purchase seedlings rather than to purchase and sow the seeds.

HOW TO TRANSPLANT.

In transplanting, whether from the seed-bed, nursery-row, or from the forest, great care must be exercised in taking up the tree. To be transplanted in the best manner practicable, a tree should be moved with its system of roots entire and uninjured. This can seldom or never be done when the trees are large, while with small seedlings the process is perfectly feasible. For this reason, it is advisable to transplant seedlings to the place they are to occupy when from one to three feet high.

Always use a sharp spade that as few roots may be injured as possible. Let two persons work together, on opposite sides, and the tree be carefully lifted rather than pulled from the ground by force. If soil adheres, all the better. Let the roots be at once protected from the sun and wind by hay-caps, rugs, or old sacks, and the trees taken as soon as may be to the spot they are to occupy. Trim the injured roots, if any, and prune the top if pruning is required. Deciduous trees may be greatly improved by a judicious use of the knife. The holes must be so large as not to cramp the roots, and of such a depth that the crown of the root, when the tree is planted, will be even with the surface of the ground. Spread the roots in all directions, like the spokes in a wheel; fill fine dirt under, around, and over the roots, and make the ground compact by pressure with the foot. The use of water is seldom required, and then only to moisten the roots so that the dirt will adhere. Mulch in time of drouth.

When the land to be planted will admit, the ground should be plowed in the fall previous, and harrowed and furrowed in spring with broad furrows at suitable distances for rows. This will aid very much in the labor of transplanting. Seeds of the white birch may be sown between the rows, and they will arrive at maturity and may be cut before pine will be of suitable size.

WHAT TREES TO GROW.

This question should be well considered before the work is commenced. In the first place it will be well to confine ourselves mainly to a selection from native species. Foreign trees, though they seem to be hardy, do not continue to flourish for many years in this climate, not even when petted as ornamental trees. In making a list they had better be omitted, with few exceptions.

Select trees of rapid growth that make valuable lumber. The white, or Weymouth pine, stands at the head of the list. The red pine *(Pinus resinosa)* is not only a valuable, but also a beautiful, tree. It will succeed on, and in fact prefers, a dry, sandy soil. It is everywhere hardy, and makes a quicker and straighter growth than the pitch pine *(P. rigida)*. All of the pines will grow on a poor soil, but the two first named are best for timber.

As the different species of trees suited to our soil and climate will be fully treated elsewhere in this report, we pass the subject with the general remark that the pines, hemlock, larch, spruces, hickory, walnut, chestnut, oak, beeches, birches, linden, ashes, and maples, will be found the most profitable for the purpose under consideration.

It seems hardly necessary to suggest that the species and varieties to be planted should be adapted somewhat to the soil and situation they are to occupy. The young man who should plant the oak, hickory, or cedar, on a dry, barren plain, would hardly live long enough to reap a harvest of timber. The same tract planted with the pines, larch, or white birch, would be fit to cut in thirty years. There are some trees, such as the willows, that flourish on the borders of streams and on land too wet for growing the most valuable lumber. The cedar, larch, spruce, and arbor-vitæ will all grow on swampy ground, but the growth will be slow.

THE TIME TO TRANSPLANT.

The best season for transplanting all trees in this latitude is early in the spring, as soon as the ground has become warm and friable, and just as the buds begin to swell. The habit of the different species should be watched, and it will serve as our best guide. Some few commence their growth almost before the frost leaves the ground, while others sleep till June. As a rule, deciduous trees require transplanting earlier than the evergreens, the buds of which seldom push before the last of May.

All hardy deciduous trees may be safely moved in autumn, and this season has the advantage of affording more leisure for performing the work with care. When the fall is chosen, let it be as early as possible,—as soon as the leaves drop. If all bruised and broken roots are smoothly cut back to sound wood, the wounds will callous over, and new roots push before the ground freezes. Such trees, if not injured by extreme cold, will start early, and make a much stronger growth the following year.

TRANSPLANTING EVERGREENS.

The work of transplanting evergreens had better be deferred till spring. Instances occur where they are successfully moved in autumn, but it is hardly advisable to try the experiment. They may be transplanted later than other species, as they remain dormant till about the first of June. When the sap moves they push rapidly and make their entire growth in a few weeks, after which they do little more than ripen the wood already formed. Were it not for long months of exposure to our drying winter winds, during which time no roots are formed to supply moisture, the fall would be the preferable season for transplanting them. When the trees have been repeatedly moved in the nursery, so as to form a perfect mass of fibrous roots, they may be transplanted at almost any time. In this case the whole system of roots, with soil attached, is simply transferred from one spot to another, and the tree receives no shock.

Many thousands of small evergreens are annually shipped from Maine, taken directly from the pastures, that are thickly seeded with them, and sent to all parts of the country, mostly to nursery-men. They are thickly planted in rows, in some half shady place, and grown till they are in a condition to sell. These trees usually cost four or five dollars a thousand. Many die the first year, but when well established they may be handled with little or no risk.

PRUNING AND THINNING.

Evergreens require little or no pruning, as they naturally take the most desirable form. It is only when they are to be trained as specimen trees that the nursery-man uses the knife or shears. Young forest trees of any kind are likely to get very little pruning. Yet the labor is less than many might suppose, and it would be poor economy to entirely neglect it.

In stocking a tract of land with trees, I would set ten times as many as could grow to full size, and thin out as it might become necessary. The trees cut out from time to time would amply repay for the labor. If evergreens are set at too great a distance, their lower branches will remain green and spread widely in all directions, giving a heavy growth of wood, but timber of little value. If set ten feet apart each way, 435 trees will be required for an acre, while if set five by five feet, it will take 1,742 for an acre. By crowding the trees when young, they will take a more upright form, and give in the end a more valuable growth. Where trees such as the European larch, sugar maple, Norway spruce, or linden, are grown, an income may be derived by setting thick, and thinning to meet demands for ornamental planting. One tree to the square rod, when one foot in diameter, will make a heavy growth, but it would be absurd to set only 160 seedlings on an acre. Better plant thickly and transplant to other tracts, or cut out, as occasion may require.

Trees will make but a slow growth on land where the sod is unbroken, and thick planting on such land will soon completely shade the ground and kill the grass, ferns, and the like, so as to have the land loose and mellow. Trees thickly planted afford a mutual protection to each other against the summer sun and winter blasts, and the annual leaf harvest that they shed excludes frost from the roots, enriches the soil, and promotes a vigorous growth.

FOREST FIRES.

The ruinous destruction of our forests by fire is a matter within the observation of all. No season passes but the tracks of this devouring element are left more or less broadly in every county of the state. In dry seasons its devastation is often wide-spread and alarming; and the loss of property, to say nothing of other injuries consequent upon the havoc it makes with the forest growth, is so great as to make the question of staying or curtailing its ravages one of serious importance, if not of first magnitude, among the economic questions of the state.

A statement of the value of the property thus destroyed, and the causes and origin of our constantly recurring forest fires, for a series of years, would be of the greatest interest and usefulness in determining what protective measures the legislature ought to adopt. In the absence of such statistical information, we shall quote briefly, from Dr.Hough's Forestry Report for 1877, some facts and estimates of the destruction and loss from this cause in other countries under conditions of climate, etc., resembling ours, and shall then venture a comparative estimate, founded upon the best observation and inquiry we have been able to make, as to the pecuniary loss thus entailed upon the people of this state during the past twenty-five years.

"The repeated and disastrous fires in the region of Manres and l'Estérel [in France], some forty by seventy miles in extent, on the shores of the Mediterranean, between Nice and Marseilles, led the administration a few years since to make special investigations, with the view of finding the proper means for prevention. The wooded surface exposed to these fires amounted to 111,331 hectares. As the conditions were not unlike those that may be met in this country, this matter becomes one of practical interest. The region possessed a rich soil, was exposed to an ardent sun, and was watered by abundant rains at a season most proper for giving exceptional vigor to forest vegetation, and, as a consequence, an abundant accumulation of litter. From 1838 to 1848, 40,000 hectares of the 111,331 were burned over, causing 4,000,000 francs loss. From 1848 to 1868, 25,000 hectares were ravaged, at a loss of 5,000,000 francs."

"The official reports of Austrian forests for 1876, show that 170 fires had occurred in their woodlands during that year, of which the cause was accident in forty-six cases, malice in 11, locomotive sparks in 1, and unknown in 112. The area burned was 841 hectares" (2,077.7 acres).

"The commissioner of crown lands in the province of Quebec, in his report for 1871, says, 'The most formidable agent in the destruction of our forests is certainly *fire*. All the most active operations in lumbering which have taken place since the settlement of the country, and all those which are likely to take place for the next twenty years, have not caused, and will not cause, to our forest so much devastation as this destroying element has effected to the present time.'"

In a report on forestry and forests of Canada, by H. G. Jolly, member of the dominion council of agriculture, it is estimated that "more pine timber has been destroyed by fire than has been cut down and taken out by the lumberman. Not only is the large ripe timber destroyed by fire, but all the young trees, too, upon whose growth we must depend for the restocking of our forests."

In 1878 a select standing commitee of the dominion parliament instituted an inquiry into the condition of the forests of the country, and the extent, value, and prospects of the lumber trade. In the course of investigation Mr. Stewart Thayne, an English journalist, who had for the last five years been engaged in researches having reference to the lumber interest, and who had been for two and a half years exclusively engaged in studying the subject of timber resources in Canada, gave his opinion that $5,000,000 was the *lowest* estimate of the average annual loss through the forest fires in the Ottawa valley alone.

In a report on the necessity of preserving and replanting forests, compiled at the instance of the government of Ontario, by

R. W. Phipps, published in 1883, occur the following observations, which are quoted as well for the pertinency of their application here as for the facts they embody.

"The great difficulty in maintaining forests in this country lies in protecting them from the ravages of fire, to which they are peculiarly subject. Our hot summers dry the edge of the forest, the cuttings left by the lumberman greatly increase the danger, the cattle of the settlers dry and impoverish the edge of the forest for many miles, a dry season comes, fire is ignited by the clearing fires of the settlers, by those of the lumberman or the hunter, or it may be at some point where the railway has touched the forest line by a spark from a locomotive. The terrible devastation caused by these fires, when under full headway, is ruinous beyond imagination. Hundreds and thousands of square miles of beautiful forest have been reduced to ashes in periods of a fortnight or even a week. It has been well remarked by persons fully competent to express an opinion on the matter, that fire destroys more timber in Canada than the axe."

In the small state of New Jersey alone, in the dry season of 1872, it was the estimate of a very intelligent observer that 100,000 acres were burned over, causing a money loss in timber of $1,000,000.

It is an opinion in which we all concur, that within the past twenty-five years at least one fourth as much in value of forest growth has been destroyed by running fires in this state as has been cut and converted to useful purposes by the lumberman and the farmer; and this estimate does not make any account of the fact that where fire runs, the whole growth, that which is too small to have a present mercantile value, as well as that which is fit for lumber and fuel, is destroyed, and oftentimes the vegetable mold burned off to a depth which leaves the surface so barren and inhospitable (to say nothing of its unsightliness), that the regenerating power of centuries will be required to restore it. If the above estimate should be thought too high, let it be modified to meet the most moderate views of any intelligent observer, and it will still be conceded that the losses from this cause, during the period mentioned, have been very great indeed, probably not less than the war debt of the state; and all will agree that if a remedy, or a partial remedy, can be found it ought to be found, and most carefully and diligently applied.

The great bulk of forest fires may be charged to the following causes:

1. Carelessness in kindling and guarding fires set for the purpose of clearing land of brush and rubbish for purposes of cultivation.

2. Carelessness of hunters and fishermen and parties traversing and camping in the woods for health and recreation, in the use and care of fires kindled for cooking and other purposes, and in not completely extinguishing all fires started by them, whether by design or accident, before leaving the place.

3. Recklessness of lawless strollers, smokers and boys, in kindling fires either intentionally, for some supposed purpose, and leaving them unextinguished, or, mischievously, to see the conflagration, or heedlessly, by throwing down fire from a pipe or the stump of a cigar and paying no attention to the result.

4. Railway locomotives.

5. Incendiarism, in which may be included as well those set from a spirit of wanton mischief as those set out of special malice against the owner.

A brief statement of the law bearing on the subject, as it at present exists, may be useful in considering the question whether anything further in the way of legislation is desirable.

1. In the first place we have a general provision that "Any town may make and establish such rules and regulations respecting the kindling, guarding, and safe-keeping of fires, and for removing all combustible materials from any building or place, as the safety of the property in such town may require; and may appoint in such manner as may be prescribed in such regulations, all such officers as may be necessary to carry such regulations into effect, and affix penalties not exceeding ten dollars for any offence, to be recovered in such manner and appropriated to such use as the town may direct." Gen. Laws, c. 37, sec. 7.

2. "If any person shall wilfully and maliciously burn any stack of corn, hay, grain, or flax, or any fence, or pile of boards, lumber or wood, or any trees or underwood of another, he shall be imprisoned three years, or fined not exceeding one thousand dollars and imprisoned not exceeding one year.

"If any person kindles a fire by the use of fire-arms, or by any other means, on land not his own, he shall be fined not exceeding ten dollars; and if such fire spreads and does any damage to the property of others, he shall be fined not exceeding one thousand dollars, or imprisoned not exceeding three years.

"If any person for a lawful purpose kindles a fire upon his own land, or on land which he occupies or is laboring upon, at an unsuitable time, or in a careless and imprudent manner, and thereby injures or destroys the property of others, he shall be fined not exceeding one thousand dollars.

"If any person, with intent to injure another, kindles or causes to be kindled a fire on his own or another's land, and thereby the property of any other person is injured or destroyed, he shall be fined not exceeding two thousand dollars, or imprisoned not exceeding three years." Gen. Laws, c. 280, secs. 3, 4, 5, 6.

3. "The proprietors of every railroad shall be liable for all damages which shall accrue to any person or property by fire or steam from any locomotive or other engine on such road." Gen. Laws, c. 162, sec. 8.

The court has held that this law makes the liability of railroads absolute like that of insurers, and that the concurring fault or carelessness of the plaintiff, in leaving combustible litter scattered about his premises, or in leaving his property in an exposed situation, furnishes no excuse or defence in case of such burning.

4. To the above statute provisions may be added the common-law doctrine, that any one who, by carelessly kindling or negligently tending and guarding a fire upon his own land causes injury to the property of another, by the escape of such fire, is liable in damages to the extent of the loss inflicted.

It is doubted whether the statutes above quoted have had any very appreciable effect in curtailing the number or destructiveness of forest fires since they have been in force. The first clothes towns with considerable power, which, if used to the fullest extent, under wise and intelligent direction, might perhaps produce beneficial results. But that statute seems to have been always regarded as intended for the protection of buildings and property in the compact parts of towns, no instance having come to our knowledge where its provisions were invoked for the protection of woodland or forest. It is very clearly inadequate, in any view, for the single reason (even if no other could be urged against it) that by leaving the matter in the hands of the several towns it fails in the important matter of uniformity and consistency in its provisions, and the manner of its enforcement. One town may establish one set of rules, the next another, the next none at all. Of three towns which have established a code of rules on the subject, the first may enforce them rigidly, the second languidly, while the third does not attempt to enforce them at all. It is manifest that a local option law on this subject can never be of much practical use.

As to the four sections quoted from Chapter 280 of the General Laws, no conviction obtained under either of them has ever come to the knowledge of either of us, and we believe it is true that but little good, if any, has resulted from those provisions. One reason may be that, although the crime against which penalties are denounced, when the property destroyed is a forest, consists in the killing of living things, and so seems almost akin to murder, still its atrocity is not of such a nature as to startle or arouse the community and convert every man into a detective, like many offences of much less real enormity against the person or against property. Another reason undoubtedly is the great difficulty in fixing the crime upon the actual perpetrator, that is, in procuring evidence sufficient for the conviction of the guilty. In summer the woods of this state may, without much exaggeration, be said to be full of hunters, fishermen, health seekers, lumbermen, rivermen, boys, strollers, tramps, some of whom are careless, while some others may be ill-conditioned, reckless, or malevolent; and the difficulty of tracing a fire started by any such person to its real author is so great as to discourage the effort when it is to be undertaken on private account, especially when no considerable private gain is to be the reward of success.

The statute fixing the liability of railroads is, without a doubt, sufficiently stringent; and it probably has had considerable efficacy by stimulating the vigilance of those corporations, in protecting our forests against a cause which in other states and countries often produces wide-spread and desolating fires.

The common law liability above referred to, also, has beyond doubt a very wholesome as well as a very appreciable restraining influence upon the conduct of persons of pecuniary responsibility in the use of fire on their own premises. Suits by injured parties, to recover the damage thus caused, are of frequent occurrence, and the inclination of juries, so far as our knowledge extends, seems to be in the direction of holding parties to a pretty high degree of care in the use of this dangerous and destructive element.

But after all it seems to us the law stops considerably short of affording the measure of protection and security which the people may fairly expect and require.

In other countries, especially in Europe, where the subject of forest protection has long engaged the attention of government, stringent regulations with respect to the kindling and guarding of fires have been adopted, and corps of officers, constituting a sort of forest police, appointed, with the duty to watch and guard them, detect violations of the law, and prosecute offenders. It may not yet be time to recommend the adoption of such a scheme in this state, although it is not to be doubted that the benefits arising therefrom would many times overbalance the expense. But it seems to us our system of town governments furnishes the machinery, ready made, as it were, whereby a very considerable proportion of the benefits arising from these foreign schemes of forest supervision may be realized at a very inconsiderable expense. The following outline of a plan is suggested, which, it seems to us, might be safely tried, and which, we believe, if carried out, would effect a saving of private property from destruction each year, by forest fires, within the state, to an amount vastly greater than the expense of putting it in force, to say nothing of benefits more public in their nature, such as the preservation of our water-supply for manufacturing and domestic uses, the amelioration of our somewhat rigorous climate, and the protection of the unsurpassed beauties of our natural scenery against the scars and blotches with which fire has at one time or another disfigured every one of the landscape pictures spread out in such profusion and such infinite variety from Connecticut lake to the Massachusetts line.

Constitute selectmen fire commissioners for their respective towns, giving them authority, and making it their duty, to use all necessary and reasonable means and expedients to prevent and arrest the ravages of forest fires, including the employment of watchmen and patrols, when, on account of the dryness of the season, the existence of fires in the neighborhood, or other cause, danger is believed to be imminent. Require them to use great diligence to discover, whenever possible, the cause and origin of fires, and in all cases where they are found to have originated from the unlawful act of any person, to cause the offender to be prosecuted without delay. Make it the duty of county solicitors to institute and carry on such prosecutions at the expense of the county, whenever a probable cause shall be shown by any selectman or other person. Give selectmen authority to call upon citizens of the town to turn out and assist in extinguishing or staying the progress of such fires. Require them to keep a record of all such fires, with an estimate of the damage done by each, and the cause or probable cause of its origin, and return a copy thereof to the secretary of state each year.

Forbid, under a heavy penalty, the setting of fires between the first of May and the first of October, in any slashes, old pasture, field, or other place, for the purpose of clearing the land, where any portion of the material to be burned extends within one mile of any forest, without a permit signed by at least one of the selectmen; and make the offender liable in a civil action to any person injured by fire set without such permit, for the amount of damage sustained, without further proof of negligence. Make it the duty of selectmen, on application for a permit to kindle a fire out-doors as above, to proceed at once to the place, and examine carefully the situation, amount, and nature of the material proposed to be fired, its proximity to other property, especially forests, the dryness of the season, the direction and force of the wind, the probability of rain, so far as it can be gathered from the appearance of the heavens, and, when practicable, from the predictions given out by good authority at Washington, and all other circumstances which ought to have weight with a prudent man in deciding whether the fire may be safely set,—a permit to be in no case granted, unless such selectman is satisfied that the proposed fire may be kindled without endangering other property. A return of all permits given, to be made by selectmen to the town-clerk, and by him recorded in a book kept for that purpose. Blank permits to be furnished to the several towns by the secretary of state, at the expense of the state. The mayor and aldermen of cities to have the same powers and duties as selectmen. County commissioners to have the same powers and duties as selectmen, with respect to unorganized places within their respective counties.

Such a plan may at first sight appear somewhat complicated and cumbersome, but it is believed that in its practical operation it would be found both simple and effective. It at least has the merit of being aimed, where all legislation on the subject, to be of much use, must be aimed, namely, at prevention. The trouble with merely penal laws is the laxity and uncertainty of their execution. The remark of Bentham, that it is the certainty rather than the severity of punishment which deters from crime, is so true, that it may safely be accepted as axiomatic whenever the question is how to protect the community against a mischief like that we are considering. Perhaps our existing laws on the subject, quoted above, may be improved. If, however, the matter is to be left to the effect of prohibition and penalty alone, we are not now prepared to suggest any substantial alteration in the law. So far as we can see, the provisions of our statute sufficiently cover the ground, and, provided they can be enforced, will doubtless afford considerable protection; but, judging from the past, we are not able to entertain the hope that without some further machinery they will be so enforced as to do much good. The subject is certainly not free from difficulties, and probably no scheme can be devised in which a few years' use and experience will not develop defects, while it at the same time suggests improvements. This, however, ought not to deter us from making trial of any plan which offers promise of reasonable success. It does not accord with the spirit of the present age, when the elements are every day and on every hand being brought more and more into subjection to man, that we sit down with hands folded, in the helplessness of terror and despair, while our beautiful heritage of wooded hills and valleys is ravaged and made desolate before our eyes by this terrible invader, year after year in the future, as it has been in the past.

Believing that something may and should be done by the legislature for the better protection and security of the great interests, public as well as private, which are every year imperilled in the state by forest fires, we offer the foregoing hints of a plan in the hope that it may at least provoke wholesome discussion, and elicit expressions of opinion from those interested in the matter, which may aid the legislature in perfecting a scheme that will be practical and effective, and so be productive of great and lasting benefits to the people of the state.

Respectfully submitted.

S. W. HALE, *Governor*,
HENRY G. JESUP,
JOSEPH B. WALKER,
WILLIAM H. HILLS,
JOSEPH BARNARD,
WILLIAM S. LADD,
ITHIEL E. CLAY,
WILLIAM F. FLINT,
Commissioners.

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ERRATUM.

In the description of *Nyssa Sylvatica*, page 44, the word "axle" should be omitted.